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## A Study of Hazardous Waste Minimization Europe: Public and Private Strategies to Reduce Production of Hazardous Waste

Alan C. Williams

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# A STUDY OF HAZARDOUS WASTE MINIMIZATION IN EUROPE: PUBLIC AND PRIVATE STRATEGIES TO REDUCE PRODUCTION OF HAZARDOUS WASTE\*

*Alan C. Williams\*\**

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\*\* Special Assistant Attorney General, State of Minnesota, and Environmental Fellow, German Marshall Fund of the United States. This article has been accepted for presentation at the World Conference on Hazardous Waste in Budapest, Hungary, October 25-31, 1987. The study on which this article is based was made possible by an Environmental Fellowship awarded by the German Marshall Fund of the United States. The Fund is a memorial established by the government of the Federal Republic of Germany to commemorate the assistance given by the United States to Germany and Western Europe through the Marshall Plan after the Second World War. The Author is also indebted to the Institute for European Environmental Policy for arranging and coordinating meetings in Europe with appropriate individuals. The Institute is headquartered in Bonn, Federal Republic of Germany, with offices in Paris and London and additional staff in the Netherlands. Special thanks is due to the following staff members of the Institute: Pascale Kromarek in Bonn, Thierry Lavoux in Paris, and Nigel Haigh in London. Finally, the Author wishes to express his appreciation to the dozens of professionals in five countries and at the European Community in Brussels who were so generous with their time and so willing to participate in an exchange of ideas about hazardous waste management. A list of principal contacts in Europe is provided in the Appendix.

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## I. INTRODUCTION

In the 1980's, the proper management of hazardous waste has captured the attention of national, state, and local elected officials, environmentalists, industry, and the public. This attention was turned at first to correcting the inadequacies of past waste management practices. Strict regulations were adopted to control the transport, storage, treatment and disposal of hazardous waste.<sup>1</sup> Massive

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<sup>1</sup> See Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901-6987 (1982) (RCRA)

expenditures of public money were authorized and major statutory changes in liability were enacted to remedy the adverse effects of past disposal methods.<sup>2</sup> But the focus of current public discussion about hazardous waste management is turning to a new question. Simply stated that question is: How can the production of hazardous waste be minimized in order to eliminate the need for treatment and disposal of hazardous waste with all of the associated environmental and public health risks?

Both the federal government and the states have begun to recognize the importance of hazardous waste minimization. In the 1984 amendments to the Resource Conservation and Recovery Act (RCRA),<sup>3</sup> Congress declared that hazardous waste minimization is the national policy of the United States,<sup>4</sup> and directed the EPA to submit a report on the subject of future hazardous waste minimization policies and programs.<sup>5</sup> The EPA report was submitted to Congress in the fall of 1986.<sup>6</sup> The Congressional Office of Technology Assessment has also published a report on hazardous waste reduction.<sup>7</sup> Meanwhile, in a recent preliminary report recommending adoption of a national groundwater protection strategy, the National Research Council has called for significant new efforts to protect groundwater by reducing the generation of dangerous chemical wastes that may find their way into groundwater resources.<sup>8</sup>

At the state level, a number of states have already implemented programs to assist waste generators to reduce their production of

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and regulations adopted by the Environmental Protection Agency under that Act. *See, e.g.*, 40 C.F.R. §§ 264-265 (1986).

<sup>2</sup> *See* Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§ 9601-9657 (1982) (CERCLA); Superfund Amendments and Reauthorization Act, Pub. L. No. 99-499, 1986 U.S. Code & Admin. News (100 Stat.) 1613 (SARA).

<sup>3</sup> Hazardous and Solid Waste Amendments of 1984, Pub. L. No. 98-616, 98 Stat. 3221 (1984).

<sup>4</sup> *Id.* § 101(b)(1), which provides that: "The Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible." The 1984 amendments also provide that the overall objectives of RCRA are to be attained in part by "minimizing the generation of hazardous waste and the land disposal of hazardous waste by encouraging process substitution, materials recovery, properly conducted recycling and reuse, and treatment . . . ." *Id.* § 101(b)(6).

<sup>5</sup> *Id.* § 224(c).

<sup>6</sup> U.S. Environmental Protection Agency, *Waste Minimization—Issues and Options* (Oct. 1986) (report to Congress).

<sup>7</sup> U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, *SERIOUS REDUCTION OF HAZARDOUS WASTE: FOR POLLUTION PREVENTION AND INDUSTRIAL EFFICIENCY* OTA-ITE-317 (Sept. 1986) [hereinafter OTA Report].

<sup>8</sup> National Research Council Committee on Ground Water Quality Protection, *Ground Water Quality Protection: State and Local Strategies* (May 16, 1986).

waste through technical, research, and financial assistance programs. While generally modest in scope, these programs nevertheless represent concrete actions toward reducing hazardous waste generation. The Environmental Defense Fund has published a comprehensive evaluation of existing state hazardous waste reduction programs.<sup>9</sup> The Natural Resources Defense Council, another private environmental organization, is working on its own waste reduction study, including development of a model state law to encourage hazardous waste reduction.<sup>10</sup> Individual states have also issued reports and recommendations about waste reduction and related programs.<sup>11</sup>

This article describes and evaluates the development and implementation of hazardous waste minimization policies in five European countries and the European Community (or Common Market). The article focuses on the manner in which European institutions, public and private, encourage the minimization of hazardous waste. For the purpose of this article, the term "hazardous waste minimization" includes any method of avoiding or reducing the production of hazardous waste that would otherwise require treatment or disposal. The definition includes changes in production methods to reduce hazardous waste by-products or to avoid the production of products that themselves may become hazardous wastes when discarded. It also includes the recycling and reuse of hazardous wastes where this eliminates or reduces the need for other methods of waste management such as incineration or disposal.

This article is based upon a study carried out by the Author that included interviews with public and private officials in Europe and collection of extensive documentation on European hazardous waste management and regulation. Over seventy individuals representing many levels of government, industry, and private organizations were interviewed during the eight weeks of the study. These interviews made it possible to learn not only about legal and policy principles affecting hazardous waste minimization, but also about the ways in which those principles are put into practice.

The first section of this article examines the context in which hazardous waste minimization policies are developed and imple-

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<sup>9</sup> Environmental Defense Fund, *Approaches to Source Reduction: Practical Guidance from Existing Policies and Programs* (June 1986) [hereinafter EDF Report].

<sup>10</sup> Telephone interview with Mr. Ned Smith, Natural Resources Defense Council, (June 20, 1986).

<sup>11</sup> See, e.g., Ca. Dept. of Health Services, *Economic Incentives for the Reduction of Hazardous Waste: Final Report* (Dec. 18, 1985); EDF Report, *supra* note 9 at App 13-App 21.

mented in the five European countries and by the European Community (EC). This section includes a discussion of governmental structure, legal authorities, and other factors that influence a particular country or the EC in its approach to hazardous waste minimization. The second section of this article examines four major institutional influences on hazardous waste minimization in Europe: government regulation; positive economic incentives such as grant, loan, and technical assistance programs; negative economic incentives such as more costly treatment and disposal requirements, waste taxes and charges, and liability and insurance costs; and private industry policies and practices. The final section of the article presents recommendations and suggestions for United States policy on hazardous waste minimization based upon the evaluation of European experience.

## II. THE CONTEXT OF EUROPEAN HAZARDOUS WASTE MINIMIZATION EFFORTS: NATIONAL AND EUROPEAN COMMUNITY APPROACHES TO REGULATION AND MANAGEMENT OF HAZARDOUS WASTE

In a general sense, European problems and practices in the field of hazardous waste are similar to those in the United States.<sup>12</sup> Past land disposal practices have left a legacy of environmental contamination and public health threats. There is still a high degree of dependence on landfilling of hazardous wastes even as the siting of new facilities becomes much more difficult. Regulations controlling the transport, treatment and disposal of these wastes are generally becoming more strict. Government and private industry realize that serious efforts are needed to reduce the amount and danger of the hazardous wastes which must be treated or disposed.

But in the specific methods used to address these common issues, the European countries differ in some important respects from the United States, and may also differ in significant ways among themselves. These differences in hazardous waste management and regulation in general, and in hazardous waste minimization in particular, can be explained in part by understanding the national and international context in which public and private policy on hazardous waste is made and implemented. This requires knowledge about the

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<sup>12</sup> This discussion is based on the Author's observations in Belgium, France, West Germany, the Netherlands and the United Kingdom. It is not meant to describe practices in all European countries.

organization and authority of the governmental agencies involved in waste issues and about other political, institutional, and geographical factors which influence a country's approach to hazardous waste management and regulation.

This section of the article is intended to provide a kind of "snapshot" of the context in which policies and programs for hazardous waste management and regulation in Belgium, France, Germany, the Netherlands and the United Kingdom are made and implemented. This includes an overview of the role of the European Community (Common Market) and the institutions that make and implement policy at the Community level.

### *A. Belgium*

The Belgian constitution, as amended in 1980, divides the country both along geographic and linguistic lines. A central parliamentary authority retains only those powers not expressly delegated to three regions: the Flemish Region, the Walloon (French-speaking) Region, and the Brussels Region.<sup>13</sup> Environmental protection is among the powers delegated to the regions, each of which has a parliamentary body with the authority to issue decrees having the force of law. The principal public agency in the Flemish Region concerned with regulation and management of hazardous waste is the Flemish Public Waste Agency (known in Belgium by its Flemish acronym OVAM).<sup>14</sup> OVAM has the authority to plan, regulate, and establish facilities for the management of solid and hazardous waste. The agency also supports some research and development of waste processing methods, and subsidizes new domestic waste treatment facilities such as incinerators. OVAM operates under the administrative auspices of the Flemish Minister of the Environment, with control exercised by the Director General of the Agency. It has about 130 employees.

The work of OVAM in the field of hazardous waste management and regulation includes: development of accurate information about waste generation, treatment, and disposal in the Flemish Region; preparation of a hazardous waste management plan; and establishment of a public-private corporation known as INDAVER to construct and operate an integrated treatment and disposal facility for

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<sup>13</sup> The Author's study covered only the Flemish Region.

<sup>14</sup> OVAM was created by the parliament of the Flemish Region in a Decree on the Management of Waste, enacted July 2, 1981. Information about OVAM and INDAVER is based on an interview with Mr. Felix Kucnerowicz, Senior Engineer, OVAM, in Mechelen, Belgium (Apr. 11, 1986) [hereinafter Kucnerowicz interview].



hazardous waste. Following the commencement of operation by IN-DAVER, OVAM anticipates further regulatory action to tighten the standards for treatment and disposal in the Flemish Region.

### *B. France*

Under the constitution of the Fifth Republic, and by long tradition, France is a unitary state in which power is centralized at the national level. Laws and decrees enacted by the national government are carried out by the agents of that government at the regional and departmental levels.<sup>15</sup> The primary regulatory institution at the national level for environmental matters is the Ministry of the Environment, where hazardous waste is regulated through the Division of Pollution Prevention. However, responsibility for hazardous waste is divided between two offices in this division: the Waste Service and the Industrial Environment Service. The Waste Service (Service des Déchets) implements the Framework Law on Waste Management adopted July 15, 1975.<sup>16</sup> Under this law, the French government has issued regulations concerning the classification and listing of substances as hazardous wastes and has required the use of a manifest system to track the transportation and elimination of hazardous wastes. The Industrial Environment Service (Service de l'Environnement Industriel) carries out the Law on Registered Installations.<sup>17</sup> This law, which has its roots in a decree issued by Napoleon in 1810,<sup>18</sup> provides for the registration or approval of any new business or industrial operation which may pose a danger or nuisance in regard to public health or safety, or protection of nature and the environment.<sup>19</sup> Construction and operating standards for waste management facilities, including locations where waste is produced, treatment facilities, and landfills, are established and enforced under this law. In addition, another law requires the preparation of envi-

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<sup>15</sup> France is divided for administrative purposes into 95 Departments and 22 Regions (each containing several departments). While the Regions have been granted limited autonomy in recent years, these administrative divisions are largely subordinate units of the central government.

<sup>16</sup> Law 75-633 of July 15, 1975, Concerning the Elimination of Wastes and Recovery of Materials, J.O. 7279-81 (Framework Law).

<sup>17</sup> Law 76-663 of July 19, 1976, Concerning Installations classified for the Protection of the Environment J.O. 4320-23 (Law on Registered Installations).

<sup>18</sup> Secretariat d'Etat à l'Environnement et à la Qualité de Vie, L'Etude d'Impact d'une Unité Industrielle 5 (Apr. 1984).

<sup>19</sup> Law on Registered Installations, *supra* note 17, § 1. The law also applies to installations posing a danger in regard to sanitation, agriculture, and conservation of sites and monuments. *Id.*

ronmental impact statements (*études d'impact*) before construction of certain installations.<sup>20</sup> The laws on registered installations and impact studies are carried out under the authority of the Prefect, the agent of the national government in each of the Departments.<sup>21</sup> However, administration and enforcement of these laws is provided by the staff of the Directorate Régionale de l'Industrie et Recherche (DRIR), who are appointed by the Ministry of Industry in each region.

Another important institution in the French system of waste management is the Agence Nationale pour la Récupération et l'Élimination des Déchets (ANRED), an agency established under the 1975 Framework Law<sup>22</sup> to encourage the development of improved waste management methods.<sup>23</sup> ANRED supports technical research and demonstration projects, participates in the development of waste treatment facilities, and assists with efforts to clean up old hazardous waste disposal sites. ANRED is under the guidance of three government ministries: Environment, Industry and Research, and Finance.

In order to provide financial incentives to control water pollution, France has established six River Basin Finance Agencies (*Agences Financières de Bassin*). These agencies collect fees on the discharge of pollutants into water. They use the revenues from these fees to subsidize treatment equipment and other management methods which reduce or avoid water pollution. These agencies are largely independent of the Ministry of the Environment and have no direct regulatory authority over water pollution or waste management. However, by charging fees for withdrawal, consumption and pollution of water, and providing financial support for waste treatment and pollution avoidance technologies, they are able to influence the way in which wastes are managed by industry.<sup>24</sup>

Thus, in the French system, responsibility for controlling and influencing hazardous waste management is divided among five major governmental entities: the Ministry of the Environment with its two separate offices regulating hazardous waste, the DRIR, ANRED, and the river basin finance agencies. Under this complex

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<sup>20</sup> Law 76-629 of July 13, 1976, J.O. 4203-06 (Nature Protection Law).

<sup>21</sup> The Prefect has been recently renamed the Commissaire de la République.

<sup>22</sup> Law 75-633 of July 15, 1975.

<sup>23</sup> The specific functions of ANRED are provided in the Decree (*Décret*) of the Prime Minister No. 76-473, arts. 1-17 (May 25, 1976).

<sup>24</sup> Interview with Yvon Raak, Director, Agency de l'Eau Artois—Picardie, Douai (Apr. 9, 1986) [hereinafter Raak Interview].

system, there have been a number of examples of slow implementation of hazardous waste authorities as well as competition and disagreement among the agencies in carrying out their responsibilities. One important part of the 1975 Framework Law, the hazardous waste *bordereau* system, was established by regulation only in 1985.<sup>25</sup> Although technical standards have been issued by the Industrial Environment Service for hazardous waste treatment and disposal facilities, there is a shortage of personnel to carry out the inspections and other enforcement activities needed to make these standards effective. This shortage of personnel also limits the effectiveness of the environmental impact study law<sup>26</sup> and the registered installation law<sup>27</sup> as tools in promoting low waste or non-waste production methods.

The two offices in charge of regulation in the Ministry of the Environment have long disagreed over the implementation of another provision of the 1975 Framework Law allowing the government to designate the hazardous waste treatment and disposal facilities that are approved to offer particular services.<sup>28</sup> There has also been competition between ANRED and the River Basin Finance Agencies. Through the collection of fees on discharges into water, the river basin agencies are able to provide substantial subsidies to industry to implement low waste and non-waste production methods. Some agencies even subsidize transportation and disposal of hazardous waste at off-site treatment facilities.<sup>29</sup> ANRED has no similar

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<sup>25</sup> Ministry of the Environment, Order (Arrêté) of Jan. 4, 1985. The BORDEREAU system requires the use of shipping papers to track the movement of hazardous waste from a producer to its final destination at a treatment or disposal facility. *Id.* It is similar to the manifest system required under RCRA, *supra* note 1, 42 U.S.C. §§ 6922-6923 (1982).

<sup>26</sup> Law of July 10, 1976 (Act No. 76-629).

<sup>27</sup> Law 76-663 of July 19, 1976, J.O. 4320-23.

<sup>28</sup> The disputed provision is Article 9 of Framework Law. Law 75-633, art. 9 (July 15, 1975). Under Article 9, approval of hazardous waste treatment and disposal facilities would be given by the Waste Service and would affect the liability of waste producers who use the approved facilities, as well as the duty of the facility operators to provide certain treatment and disposal services. *Id.* The Waste Service supports implementation of Article 9 in order to clarify liability questions and assure adequate capacity for treatment and disposal services. The Industrial Environment Service, however, opposes implementation apparently on the grounds that it would duplicate or conflict with the authority of that office to approve treatment and disposal facilities under the Law on Registered Installations. Law 76-663 of July 19, 1976. Interviews with officials of the Ministry of the Environment, including M. Francis Combrouze, Attorney in the Waste Service (Mar. 27, 1986) [hereinafter Combrouze Interview]; Interview with Jean-Phillipe Olier, (Mar. 27, 1986) Engineer in the Industrial Environment Service [hereinafter Olier Interview]. See *infra* notes 259-282 and accompanying text for a discussion of Article 9 and other Articles of the Framework Law related to the liability issue.

<sup>29</sup> Raak Interview, *supra* note 24.

independent source of funds to support its efforts in the research, development and application of new waste management methods, relying instead on government appropriations.<sup>30</sup> A waste charge system similar to the water pollution charges imposed by the River Basin Finance Agencies has been proposed, but is generally viewed as unlikely to be adopted.<sup>31</sup>

The French institutional structure for regulating and managing hazardous wastes has been critically examined by two groups in recent years. A committee of the French Senate under the leadership of Senator Bernard Legrand and a working group appointed by the Ministry of the Environment have each published reports recommending changes in the way hazardous waste management is regulated in France.<sup>32</sup> If fully implemented, the recommendations contained in these reports would result in a stronger governmental role in the establishment, operation, and long-term safety of hazardous waste management facilities in France. At this time, however, the government is reluctant to take actions that would increase the cost of hazardous waste management in France because it would encourage generators to dispose of their wastes illegally.<sup>33</sup> This attitude of the French government marks an important difference between French policy and the hazardous waste policies of other countries such as Germany and the Netherlands. As a result of this view, regulatory and other measures which might increase disposal costs in France are discouraged, and subsidies and other measures to encourage use of approved treatment and disposal facilities are favored. It is generally recognized in France that the cost of treatment and disposal of hazardous waste does not provide enough incentive to cause generators to reduce or minimize waste production.<sup>34</sup>

To complete the picture of hazardous waste management in France, several other factors should be mentioned. For example,

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<sup>30</sup> There is one exception to this. ANRED collects a "parafiscal tax" on used oil to support development of management alternatives. Decree of the Prime Minister No. 86-549, March 14, 1986 [hereinafter Decree No. 86-549].

<sup>31</sup> Raak Interview, *supra* note 24; *infra* notes 288-293 and accompanying text.

<sup>32</sup> La Commission de Controle des Services Publics Concernant les Déchets Industriels Toxiques, Rapport No. 408 1984; Secrétariat d'Etat Chargé de l'Environnement et de la Qualité de la Vie, ELIMINATION DES DÉCHETS INDUSTRIELS (1984) [hereinafter RAPPORT SERVANT].

<sup>33</sup> Interview with M. Jean-Claude Buquet, Legal Counsel, ANRED, in Angers (Apr. 13, 1986) [hereinafter Buquet Interview].

<sup>34</sup> Interview with M. Daniel Lemarchand, Industry Department, ANRED in Angers, (Apr. 2, 1986) [hereinafter Lemarchand Interview]; Interview with M. Jean-Alain Jullien, Chief of Commercial Service, SARP Industries at Limay, France (Mar. 28, 1986) [hereinafter Jullien Interview]; Interview with M. Yann Grenet, Engineer, Waste Service, Ministry of the Environment, in Paris (March 27, 1986); Combrouze Interview, *supra* note 26.

the French government has strongly encouraged the development and use of "clean technologies" (technologies propres), primarily through the promotional efforts of the Ministry of the Environment. A clean technology is one that avoids the production of pollution at its source instead of requiring pollution control devices or "end of pipe" treatment methods. While most examples of clean technologies used in France involve avoidance of surface water pollution discharges, the concept is being extended to waste recycling and avoidance.<sup>35</sup> Other factors that appear to influence the state of hazardous waste management and regulation in France include: the large geographic area and relative sparseness of population of the country, which make it easier for generators to engage in uncontrolled waste disposal (décharges sauvages); the general lack of organized environmental interest groups on a national level; and the relatively low priority given to environmental matters in French politics.

### *C. Federal Republic of Germany*

The Federal Republic of Germany is a federal state with a national government and eleven länder or states. Under the German constitution, the federal government may enact laws and regulations in the field of environmental protection, including waste management. Implementation and enforcement of these laws, however, is generally carried out by the states. In addition, the states may enact other laws and programs to carry out their own environmental protection policies.

During the study carried out by the Author, environmental protection at the federal level was under the jurisdiction of the Ministry of the Interior in Bonn. Recently, however, a separate Ministry of Environment, Nature Protection and Reactor Safety has taken over these duties. Each state also has a ministry with jurisdiction over environmental matters. Another important German institution is the Federal Environmental Agency (Umweltbundesamt or UBA) located in West Berlin. This agency has no regulatory powers (except under the Dumping at Sea Act), but has broad authority to conduct research, to develop environmental policy, and to assist in its implementation and enforcement. The agency also administers major grant and loan programs to encourage development and use of waste technologies to minimize pollution and waste generation. Several of the German states have state agencies similar to the UBA.

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<sup>35</sup> Lemarchand, *supra* note 34.

The federal legal framework for the regulation of hazardous waste management includes three major laws. The primary legal instrument is the Waste Act, originally enacted in 1972 as the Waste Disposal Act, and amended four times since then.<sup>36</sup> The fourth amendment, which substantially rewrites the original law, was under consideration by the Bundestag (parliament) during the course of the Author's study and was subsequently enacted as the Waste Avoidance and Disposal Act.<sup>37</sup> The Waste Act authorizes the federal government to issue a list of hazardous wastes; requires the licensing of treatment, storage and disposal facilities; requires each state to prepare a waste management plan; requires generators, transporters and disposers of waste to provide certain information to the government about their activities; and regulates the transfrontier transportation of hazardous waste. As amended by the Fourth Amendment, the Waste Act for the first time establishes the prevention or reduction of waste as a national policy and authorizes the federal government to adopt regulations to implement this policy.<sup>38</sup>

The second important framework law is the Emission Control Law of 1974.<sup>39</sup> This law requires certain facilities which discharge pollutants into the environment to be licensed.<sup>40</sup> In 1985, the law was amended to require all licensed facilities to avoid or recycle all waste residues produced by the operation unless compliance is not technically feasible or is disproportionately expensive.<sup>41</sup>

The third important framework law is the federal Dumping at Sea Act, which requires a federal license for dumping or incinerating hazardous wastes at sea.<sup>42</sup> This license will be granted only if there is no technically feasible method to manage the waste on land. Under the Dumping at Sea Act, the federal government can deny a license on the grounds that there are demonstrated, feasible changes in

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<sup>36</sup> Waste Disposal Act, June 7, 1972. Bundesgesetzblatt [BGB1.I] 1410 (W. Ger.) as amended by Act of January 5, 1977, BGB1.I 141.

<sup>37</sup> *Id.* as amended by Act of August 27, 1986, BGB1.I 1410.

<sup>38</sup> *Id.* Fourth Amendment, Sections 1a. and 2., as described to the Author by Pascale Kromarek, Institute for European Environmental Policy, Bonn, Federal Republic of Germany, in telephone conversation (March 13, 1987).

<sup>39</sup> Federal Emission Control Act of March 15, 1974, BGB1.I 721 (W. Ger.).

<sup>40</sup> *Id.*

<sup>41</sup> *Id.* as amended by Act of October 4, 1985, BGB1.I 1950.

<sup>42</sup> Dumping at Sea Act, February 11, 1977, BGB1.I 165 as amended by Act of May 10, 1978 BGB1.I 613. This law was adopted to implement the CONVENTION FOR PREVENTION OF MARINE POLLUTION BY DUMPING WASTE OR OTHER MATTER, signed at Oslo on February 15, 1972. Discussion of the Dumping at Sea Act based on interviews with staff of the UBA, especially Dr. George Goosmann, in Berlin (Apr. 21, 1986) [hereinafter Goosmann Interview].

production technology or other waste minimization methods (such as recycling) that make ocean disposal unnecessary.

The regulation of waste management in Germany is an issue with high public and political visibility. There are several reasons why this is so. First, Germany has a publicly recognized problem with old waste sites that threaten groundwater supplies and public health. Second, the dangers posed by improper waste management have become an important political issue, especially through the efforts of the Green Party, a political party with a strong environmental agenda. The Green Party has recently become part of the governing coalition in the State of Hesse, where the Minister of the Environment is a member of the party. German public opinion is also reflected in strong environmental interest groups and in public opposition to the siting of new waste facilities. The relatively high population density of Germany makes it difficult to locate new facilities away from populated areas.

Perhaps as a result of the high public awareness and political visibility of the waste issue in Germany, it is widely understood that proper treatment and disposal of waste is only a partial solution to the problem. Waste avoidance and recycling are recognized as necessary parts of a complete waste management policy. Higher treatment and disposal costs, together with new regulatory and tax initiatives, are viewed as positive steps toward the desirable goal of reduced production of waste.<sup>43</sup>

#### *D. Netherlands*

The Netherlands is a unitary state, with authority vested in a national government and a number of provinces. Environmental protection laws and regulations are enacted on the national level and are carried out by the Ministry of Housing, Physical Planning and Environment and, to a lesser extent, by the provinces. The principal legal instrument for regulating hazardous waste is the Chemical Waste Act of 1976.<sup>44</sup> There is a general ban on land disposal of hazardous wastes but several exceptions have been made to allow disposal at certain sites.<sup>45</sup> Waste avoidance and recycling are viewed

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<sup>43</sup> Interview with H. Stolz, Federal Ministry of the Interior, in Bonn (Apr. 30, 1986).

<sup>44</sup> Chemical Waste Act of 1976, Bulletin of Acts, Orders and Decrees 1976, 214, *amended* Act of June 13, 1979, Act of October 7, 1981, and Act of December 14, 1983.

<sup>45</sup> *Id.* at art. 31, *see also* NETHERLANDS INDICATIVE MULTI-YEAR PROGRAMME FOR CHEMICAL WASTE, MINISTRY OF HOUSING, PHYSICAL PLANNING AND ENVIRONMENT (December, 1985) [hereinafter NETHERLANDS PROGRAMME].

as very important management alternatives and receive strong government support.<sup>46</sup> Regulation of the management of hazardous wastes once it leaves the site of generation appears to be strict and comparable to the German approach. However, the Chemical Waste Act does not require a license to manage hazardous waste at the site where it is generated. This exemption appears to leave a major gap in the regulatory scheme.

Waste management is also a subject of great public concern in the Netherlands because of the large number of old contaminated waste sites.<sup>47</sup> The Netherlands is the only country the Author visited that has established a contaminated site clean-up fund and has enacted a law authorizing recovery of clean-up costs from waste generators.<sup>48</sup> Another special factor affecting environmental regulation in the Netherlands is the existence of the Foundation on Nature Conservation and Environmental Protection in Utrecht. In addition to its role as a federation of private associations interested in the environment and nature conservation, the Foundation receives financial support from the Dutch government to research, develop, promote, and monitor Dutch environmental policy. Finally, the geology, topography and dense population of the Netherlands make the location of new land disposal facilities for hazardous waste extremely difficult.

### *E. United Kingdom*

The United Kingdom (U.K.) is a unitary state with a central government that has the authority to create and abolish local units of government and to control their powers. The central government enacts laws, regulations and guidance in environmental matters, but enforcement is left to local authorities, often with very little national review.<sup>49</sup> Such a system often results in a lack of uniform application of environmental standards. In the field of hazardous waste regulation, lack of uniformity of regulation by local Waste Disposal Au-

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<sup>46</sup> MINISTRY OF HOUSING, PHYSICAL PLANNING AND ENVIRONMENT, FACTSHEET: INDUSTRIAL HAZARDOUS WASTE MANAGEMENT IN THE NETHERLANDS 1 (1983) [hereinafter FACTSHEET].

<sup>47</sup> Interview with H. Henselmans, Foundation on Nature, Conservation and Environmental Protection, in Utrecht (May 20, 1986) [hereinafter Henselmans Interview]. See also FACTSHEET, *supra* note 46, at pp. 1-2.

<sup>48</sup> Soil Rehabilitation Law of December 29, 1982; see FACTSHEET, *supra* note 46, at p. 2.

<sup>49</sup> In August, 1986, the government of the U.K. announced the creation of a new unified national inspectorate of pollution to review compliance with laws relating to air pollution, hazardous waste, radiochemicals, and water quality. *A Unified Pollution Inspectorate Is Created*, 37 THE ENV'T IN EUR. 3 (1986).



thorities has been noted by the British government itself.<sup>50</sup> This problem may have been aggravated recently by the abolition of the London County Council and the Metropolitan County Councils, which formerly had authority over waste management in the U.K.'s largest urban areas. Authority to regulate hazardous wastes in these areas has now reverted to individual borough governments.

The U.K. differs from other European countries in the emphasis that is placed on governmental control of land use. For example, a hazardous waste treatment or disposal facility, as any other land use, must receive approval from a local land planning body before it can be constructed. Once planning approval is given, local waste disposal authorities charged with licensing the facilities in accordance with environmental standards may *not* reject a license application unless the authority can show that rejection is necessary to prevent danger to public health.<sup>51</sup> The local waste disposal authorities may set reasonable conditions on granting the license. A license may also be rejected if necessary to prevent water pollution, but this question is left to the appropriate Regional Water Authority that regulates the pollution of public waters. The presence of land use planning controls has been advanced as a reason for the lack of major problems with old contaminated hazardous waste sites in the U.K. According to this view, by requiring planning approval for industrial and all other land uses for many years, the U.K. has avoided the creation of unknown and unapproved disposal sites of the sort that have caused problems in the U.S.<sup>52</sup>

Finally, the U.K. is distinguishable from other countries in its approach to setting environmental standards. This approach affects substantive standards applied to hazardous waste management activities. The British approach to environmental standards starts from the premise that standards to control pollution can be applied at one or more points along a pollution pathway. That pathway begins at the pollution source, continues through the affected environment, and arrives at a biological target.<sup>53</sup> Environmental policy in the U.K. tends to favor the control of pollution nearest to the

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<sup>50</sup> Hazardous Waste Inspectorate of Department of the Environment, *Hazardous Waste Management: An Overview* (June 1985) [hereinafter *Hazardous Waste Management: An Overview*].

<sup>51</sup> *Id.* at 25.

<sup>52</sup> Interview with Nigel Haigh, Head of London Office, Institute for European Environmental Policy, in London (May 9, 1986).

<sup>53</sup> This analysis of the pollution pathway is illustrated in N. HAIGH, *EEC ENVIRONMENTAL POLICY AND BRITAIN* 28 (1984).

target, with environmental objectives or emission limits determined by the levels needed to protect identified targets. Uniform emission limits at the source are generally disfavored as a regulatory tool in the U.K.<sup>54</sup>

British regulation of hazardous waste shows how this approach to environmental standards may be applied. The primary legal instrument for the regulation of hazardous waste management in the U.K. is the Control of Pollution Act of 1974.<sup>55</sup> Regulations adopted under that Act define a "special waste" (comparable to hazardous waste in the U.S.) as a waste which contains a chemical compound specifically listed in the regulations and which, by reason of that chemical in the waste, has a flashpoint of 21 degrees Celsius or less or is dangerous to life.<sup>56</sup> A waste is dangerous to life under the Regulations if

- (a) a single dose of not more than five cubic centimeters would be likely to cause death or serious damage to tissue if ingested by a child of 20 kilograms body weight or
- (b) exposure to it for fifteen minutes or less would be likely to cause serious damage to human tissue by inhalation, skin contact or eye contact.<sup>57</sup>

This definition of special waste is based solely on the risk posed to human health, which is only one of the potential biological targets of exposure to such waste. The definition not only excludes any reference to environmental risk, it does not recognize other risks to human beings such as risk of damage to genetic material or human offspring, or latent risk of tissue damage or cancer.

The environmental risks posed by hazardous waste are addressed by facility siting and licensing regulations. However, there is no single set of design or operating standards for treatment and disposal facilities since discharge limits can vary according to the geology,

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<sup>54</sup> Haigh seems to be describing the beliefs of U.K. environment policymakers when he writes:

For those who believe that the purpose of pollution control is to prevent targets from being unduly put at risk, then the best points for controls are those nearest to the target. The reasons for exercising controls further back along the pathway are then practical: it simply may not be possible to exercise controls anywhere else. Viewed in this way emission standards are merely a means to achieve quality objectives which in turn are set to protect identified targets, and these emission standards need be no more stringent than required to meet those quality objectives. The emission standards will therefore quite logically vary from place to place.

*Id.* at 34.

<sup>55</sup> Control of Pollution Act, 1974 (c. 40).

<sup>56</sup> STAT. INST. 5786 (1980, No. 1709). *See* HAIGH, *supra* note 53, at 126. A waste is also a special waste under this Regulation if it is a prescription drug.

<sup>57</sup> STAT. INST. 5792 (1980, No. 1709). *See* HAIGH, *supra* note 53, at 126.

hydrology, and other characteristics of facility location. The U.K. approach to hazardous waste regulation has a number of interesting results. First, serious risks posed by the discharge of certain hazardous wastes into the environment may go uncontrolled because it is impossible to show that the amounts or concentrations involved will cause a specific injurious result to human health. Second, the case by case facility standards lead to heavy reliance on land disposal as the preferred management method for hazardous waste,<sup>58</sup> including landfills where certain liquid hazardous wastes are co-disposed with domestic garbage.<sup>59</sup> Land disposal remains a cheap and widely available option in the U.K., while treatment facilities, including incineration, get little official encouragement. Under these circumstances, the regulatory and economic pressures to avoid or recycle hazardous waste in the U.K. are very low. The U.K.'s system for regulating hazardous waste has been criticized by two major governmental reports in recent years.<sup>60</sup>

The picture of waste management regulation and practice in the U.K. would not be complete without reference to the unique geography and geology of the U.K., where no area is more than 70 miles from the sea and many aquifers receiving landfill leachate are naturally brackish and unusable for human consumption. Finally, while it is seldom articulated, the U.K.'s approach to environmental standards may be influenced by the needs of a struggling national economy and the desire of the current government to reduce the regulatory presence of government in the private marketplace.<sup>61</sup>

#### *F. The European Community (EC)*

The European Economic Community (now generally known as the European Community or EC) was established by the Treaty of Rome

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<sup>58</sup> Interview with John Eberlein, Director Division of Environmental Affairs, Shell U.K., in London (May 13, 1986) [hereinafter Eberlein Interview].

<sup>59</sup> The U.K.'s landfill co-disposal policy is based on research by Harwell Laboratories (a government-sponsored research institution) showing that leachate from landfills using this method posed no serious danger to groundwater. The continuing validity of this research is now being questioned. See, *Do Landfills Pose a Threat to Britain's Aquifers?*, 129 ENVTL. DATA SERV. 13-15 (1985).

<sup>60</sup> Hazardous Waste Management—An Overview, *supra* note 49; and *Managing Waste: The Duty of Care*, Eleventh Report of the Royal Commission on Environmental Pollution, Her Majesty's Stationer's Office (HMSO).

<sup>61</sup> For example, the current government of Prime Minister Thatcher has proposed to sell the local water authorities to private interests. These authorities not only provide public water supplies, but also regulate water quality. See *But Who Prosecutes the Polluters*, *The Times*, April 29, 1986.

in 1957. It is sometimes referred to as the Common Market. Although protection of the environment was not expressly mentioned in the Treaty of Rome, the EC began to develop a community environmental policy in 1972 under Article 235 of that Treaty, which allows the EC to take actions necessary to attain treaty objectives even where powers are not expressly provided to do so, and under Article 100 allowing harmonization of national regulations.<sup>62</sup> EC environmental policy from 1972 to the present has been based upon the recognition that protection of the environment is closely tied to economic well-being.<sup>63</sup> Recent proposed changes to the Treaty of Rome, adopted by the heads of government of the EC Member States in December 1985, expressly recognize the authority of the EC to develop and implement a community environmental policy and include a requirement that community environmental policy be integrated with other EC policies.<sup>64</sup>

EC environmental policy, like other EC policies, is made through the unique governing institutions of the community.<sup>65</sup> These institutions consist of the Council, the Commission, the Parliament, the Court of Justice, and the Economic and Social Committee. For major policy decisions, the Council is made up of the heads of government of the twelve Member States.<sup>66</sup> Otherwise, the Council consists of the Foreign Ministers or the Ministers who have authority over the particular policy or matter in question. The Council is the primary legislative body of the EC, with authority to adopt legislation in several forms, including directives and regulations which have binding force on Member States.

The Commission consists of members appointed by the Member States. Two commissioners are appointed by Germany, France, Italy, Spain, and the U.K., and one commissioner is appointed by each of the other seven countries. Commissioners take an oath that

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<sup>62</sup> The discussion on the origin of EC environmental policy is based on information from COMMISSION OF THE EUROPEAN COMMUNITIES, TEN YEARS OF COMMUNITY ENVIRONMENT POLICY (Mar. 1984).

<sup>63</sup> *Id.* at 12.

<sup>64</sup> The treaty changes are incorporated in a document entitled the "Single European Act," which has been ratified by all EC Member States except Ireland. See *The Environment Finds a Place in the 'Single European Act'*, 35 THE ENV'T IN EUR. 1 (1986). The Author is grateful to have had the opportunity to assist in the English translation of this article during the visit to Bonn.

<sup>65</sup> The general source of information for this description of EC institutions is N. HAIGH, INFLUENCING THE EUROPEAN COMMUNITY INSTITUTIONS (1985).

<sup>66</sup> The Member States of the EC are: Belgium, Denmark, Federal Republic of Germany, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom.

they are free from influence from their national governments. The Commission has independent status from the Council. Only the Commission has the authority to propose legislation to the Council. Once proposed, only the Council can adopt the legislation. In addition to participating in the legislative function, the Commission enforces legislation after it is adopted, including bringing Member States before the Court of Justice for failure to carry out their obligations.

Supporting the work of the Commission are the various offices known as Directorates-General (DG). Environmental matters are under the jurisdiction of the Directorate-General for the Environment, Consumer Protection and Nuclear Safety (DG XI), although others such as DG XII (Science, Research and Development) and DG III (Internal Market and Industrial Affairs) also play some role in such matters. The staff of DG XI prepares drafts of environmental legislation and the EC Action Programme on the Environment.<sup>67</sup> The Commission also provides limited financial support for the development and demonstration of clean technologies and for projects to promote nature protection and to demonstrate clean-up techniques for contaminated hazardous waste sites. Under an informal agreement among Member States, the Commission has the power to review proposed national laws and regulations affecting the environment and, in effect, to suspend their operation for five months if the Commission finds that the matter is appropriate for action at the EC level.

The Parliament, with offices in Brussels and its seat in Strasbourg, is directly elected by the citizens of the Member States and has the authority to advise the Council. While its opinion must be sought before the Council may adopt certain legislation, the Parliament has no legislative authority of its own. The Parliament can exercise influence over the Council and Commission through its debates, reports and resolutions.

The Court of Justice, located in Luxembourg, is made up of judges appointed by the Member States. Suits can be brought in the Court concerning the enforcement of community legislation. While the Court cannot impose sanctions on Member States, its decisions are generally accepted by them.

Finally, the Economic and Social Committee has the authority to give its opinion on certain proposed legislation. The Committee is

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<sup>67</sup> The EC Action Programme on the Environment is a four year plan setting forth the environmental policy objectives and strategy of the EC and the priorities for action by the Commission.

composed of representatives of labor, employers, and other interest groups such as environmentalists. Members are appointed by their respective governments.

The EC has adopted three Action Programmes on the Environment since 1972, the latest four-year plan expiring in 1986. The Commission issued a draft of the fourth programme in September, 1986, but the programme has not yet been adopted by the Council.<sup>68</sup> In addition, five Council Directives have been issued on the subject of waste management, and others have dealt indirectly with waste.<sup>69</sup> The Directives have generally provided a framework to be filled in by legislation in the Member States.

An underlying purpose of the EC Directives is the harmonization of regulations of hazardous waste in the Member States. The weakness of the Directives lies in their generality. Technical standards for waste management continue to vary widely among the Member States, reflecting the political, economic and regulatory forces at work in each country. One possible opportunity for the EC to encourage uniform technical standards may be through a proposal on hazardous waste liability which the Commission is scheduled to present to the Council late in 1986.<sup>70</sup> The Council has committed itself to determine, not later than September 30, 1988, "the conditions for implementing the civil liability of the producer [of hazardous waste] in the case of damage or that of any other person who may be accountable for the said damage, and a system of insurance."<sup>71</sup> One

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<sup>68</sup> *Ambitious EC Action Programme on Environment*, 37 THE ENV'T IN EUR. 1-2 (1986).

<sup>69</sup> The principal EC Directives affecting waste include:

- 1) *Council Directive 75/442 on waste* (July 15, 1975), reprinted in 18 O.J. EUR. COMM. (No. L194) 39 (1975).
- 2) *Council Directive 78/319 on toxic and dangerous waste*, (Mar. 20, 1978), reprinted in 21 O.J. EUR. COMM. (No. L84) 43 (1978).
- 3) *Council Directive 76/403 concerning the management of polychlorinated biphenyls (PCBs)* (Apr. 6, 1976), reprinted in 19 O.J. EUR. COMM. (No. L108) 41 (1976).
- 4) *Council Directive 75/439 on the management of waste oils* (June 16, 1975) reprinted in 18 O.J. EUR. COMM. (No. L195) 23 (1975).
- 5) *Council Directive 84/631 on transfrontier shipment of hazardous waste* (Dec. 6, 1984), reprinted in 27 O.J. EUR. COMM. (No. L326) 31 (1984).
- 6) *Council Directive 80/68 on protection of groundwater against pollution caused by certain dangerous substances* (Dec. 17, 1979), reprinted in 23 O.J. EUR. COMM. (No. L20) 43 (1980).
- 7) *Council Directive 85/374 on liability for defective products* (July 25, 1985), reprinted in 28 O.J. EUR. COMM. (No. L210) 29 (1985).

<sup>70</sup> Interview with Ludwig Krämer, Attorney, Commission of the European Communities, DGXI (Environment, Consumer Protection, and Nuclear Safety), in Brussels (Apr. 10, 1986) [hereinafter Krämer Interview].

<sup>71</sup> Council Directive 84/631, *supra* note 69, at Article 11, paragraph 3 reprinted in 27 O.J. EUR. COMM. (No. L326) at 35.

approach to the liability issue currently under consideration is to require producers of hazardous wastes, as a condition of avoiding further liability, to deliver the waste to approved facilities that will apply specific techniques of treatment and disposal appropriate for that waste.<sup>72</sup>

The effective implementation of EC environmental policy and its waste directives is a slow process. The Commission plans to take a more active role in the future in encouraging expeditious and effective implementation of Directives by Member States, rather than the more passive reviewing role often played in the past.<sup>73</sup> Some public and private officials in Member States see the EC as a forum in which hazardous waste regulatory issues can be resolved more effectively than at the national level.<sup>74</sup> It remains to be seen whether this hope is well-founded.

### III. INSTITUTIONAL FACTORS INFLUENCING THE MINIMIZATION OF HAZARDOUS WASTE IN EUROPE

Public and private institutions influence the minimization of hazardous waste in a variety of ways. This section of the article examines four major institutional influences on hazardous waste minimization in Europe: (1) government regulation; (2) financial and technical assistance providing positive incentives for minimization; (3) waste management costs providing negative incentives for minimization, including the cost and availability of alternative waste management methods, waste taxes and charges, and liability and insurance issues; and (4) industry policies and practices encouraging waste minimization. The final section of the article will provide recommendations for waste minimization efforts in the United States that are suggested by European experiences.

#### A. *Government Regulation*

A variety of regulatory instruments are used in France, Germany and the Netherlands to encourage hazardous waste minimization. These regulations have several characteristics in common. First, the regulations aimed at waste minimization are generally part of some

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<sup>72</sup> Krämer Interview, *supra* note 70.

<sup>73</sup> *Id.*

<sup>74</sup> Interview with Dr. Herwig Hulpke, Director, Environmental Department, Bayer A.G., in Bonn (May 7, 1986) [hereinafter Hulpke Interview]; Interview with Mr. Harvey Yakowitz, Waste Management Policy Working Group, Organization for Economic Cooperation and Development, in Paris (Apr. 14, 1986) [hereinafter Yakowitz Interview].

other regulatory program such as the authorization of new industrial plants or the issuance of permits to discharge pollutants into the environment. Second, the regulations generally do not set specific standards for the types and amounts of hazardous waste that should be avoided or reduced. The great variety of industrial processes and wastes generated discourages the use of limits such as those which are applied to discharges of specific pollutants into air and water. Third, implementation of hazardous waste minimization regulations requires a high degree of technical knowledge about industrial processes and alternative production, treatment, and recycling technologies. This section of the article reviews the regulatory approaches to hazardous waste minimization now in place in France, Germany and the Netherlands.

#### 1. Authorization of New or Modified Industrial and Commercial Installations: French Law and Practice

Under French law all industrial and commercial operations that may pose a danger to public health and safety, the environment, or neighborhood amenity, are subject to government control.<sup>75</sup> Installations that threaten a grave danger or nuisance with respect to the interests protected by the law must obtain authorization before commencing or modifying their operations. All other installations must file a declaration with the appropriate authorities before operating. There are currently about 600,000 installations subject to this law, with about 50,000 subject to authorization.<sup>76</sup> Of the facilities subject to authorization, about 300 of the most dangerous are subject to an additional review by the Ministry of the Environment.

Applications for authorization are filed with and reviewed by a regional office of the Ministry of Industry known as the DRIR (Directorate Régionale de l'Industrie et de la Recherche).<sup>77</sup> The DRIR is responsible, under the authority of the Prefect of the Department where the facility is located, for identifying and negotiating the terms of an authorization order and for inspection and enforcement activities with respect to authorized facilities.<sup>78</sup> The authorization order itself is issued by the Prefect. The procedure and requirements for authorization are set forth in regulations issued by the national

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<sup>75</sup> Law 76-663 of July 19, 1976, J.O. 4320-23 (Law on Registered Installations).

<sup>76</sup> Olier Interview, *supra* note 26.

<sup>77</sup> See *supra* notes 15-35 and accompanying text.

<sup>78</sup> DIRECTION RÉGIONALE DE L'INDUSTRIE ET DE LA RECHERCHE, DES HOMMES AU SERVICE DE L'INDUSTRIE.



government.<sup>79</sup> The procedure includes public notice and hearing, and requires the submittal of an impact study as required by a separate French law.<sup>80</sup> The entire authorization process may take six months to complete.<sup>81</sup>

If the facility includes a manufacturing process, that process and the products to be produced must be described in the authorization application in such a way that potential dangers can be evaluated. The requirements of the impact study are more specific, particularly with regard to pollution issues. The impact study must "specify the origin, nature and scale of any nuisance likely to result from the operation of the installation in question. For this purpose, it shall in particular specify . . . measures proposed for . . . the removal of wastes and residues from the installations . . . ."<sup>82</sup> The DRIR may require the applicant to describe the available production and recycling technologies and explain why technologies have been selected which do not minimize pollution. Certain types of installations must comply with specific technical instructions issued by the Ministry of the Environment. These instructions may establish emission limits for air and water discharges and require more detailed consideration of an installation's waste streams. An example of this is the technical instruction on metal-plating operations,<sup>83</sup> which sets maximum concentration limits for particular substances in waste water and requires the use of best available pollution control technologies, with an emphasis on recycling and regeneration of plating baths.<sup>84</sup> The waste provisions of this instruction require the use of authorized treatment and disposal facilities, filing of waste management reports at least annually, and compliance with waste storage rules.<sup>85</sup> This instruction also provides broad authority to the Prefect to prohibit the use of any method of waste management that does not produce the best results for environmental protection.<sup>86</sup>

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<sup>79</sup> Decree of September 21, 1977 (No. 77-1133) *reprinted in* MINISTÈRE DE L'ENVIRONNEMENT ET DU CADRE DE VIE, *INSTALLATIONS CLASSÉES POUR LA PROTECTION DE L'ENVIRONNEMENT* 15 (1977) [hereinafter *INSTALLATIONS CLASSÉES*].

<sup>80</sup> Law 76-629 § 2 of July 10, 1976, (Nature Protection Law).

<sup>81</sup> Interview with Jean-Jacques Fidon, Engineer, FAIRTEC Anti-Pollution Systems, in Suresnes, France (March 28, 1986) [hereinafter *Fidon Interview*].

<sup>82</sup> Decree of September 21, 1977, *supra* note 79, *reprinted in* *INSTALLATIONS CLASSÉES*.

<sup>83</sup> Ministry of the Environment, Annexe to the Ministerial Order (Arrêté) of September 26, 1985.

<sup>84</sup> *Id.* Art. 3, 3.2.

<sup>85</sup> *Id.* Art. 15-17.

<sup>86</sup> *Id.* Art. 18.

In approving an authorization for an installation that produces waste, the Prefect may impose technical requirements affecting the production of pollutants, including hazardous waste. It is possible for the DRIR to consult with ANRED when drafting the technical requirements for a particular facility. The Ministry of the Environment encourages the integration of these requirements into the production processes so that less pollution is produced and recycling is used where appropriate.<sup>87</sup> To the extent possible, these technical requirements are supposed to be formulated in terms of performance objectives rather than specific technical methods.<sup>88</sup>

Government authorization of industrial and commercial operations, combined with the impact study, provide a useful regulatory tool to encourage hazardous waste minimization. But the current implementation of these regulations is probably inadequate to achieve significant results. The reasons for this are several. First, the DRIR does not have sufficient personnel to properly review applications or enforce technical conditions. In one heavily industrialized region in northern France with 4000 authorized installations, there are only fifteen engineers working on all environmental matters.<sup>89</sup> According to one commentator, the average number of inspectors for authorized installations throughout the country is one inspector for more than 1000 installations.<sup>90</sup> A second problem with current implementation is that the authorization application and impact study may not require enough detailed information concerning alternate production technologies that minimize waste by-products, or about recycling and reuse of wastes. Without such information, there is an insufficient basis to set technical requirements for waste minimization. Finally, there is a need for more effort to develop new low waste and non-waste technologies and to inform both industry and government regulators about the applications and capabilities of these new technologies.<sup>91</sup> Because of these problems, it appears unlikely that the authorization requirements (including the impact

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<sup>87</sup> SECRÉTARIAT D'ÉTAT À L'ENVIRONNEMENT ET À LA QUALITÉ DE VIE, L'ENVIRONNEMENT INDUSTRIEL ET AGRICOLE, 5.

<sup>88</sup> *Id.*

<sup>89</sup> Interview with Mme. Rousseau, DRIR, Nord/Pas-de-Calais, in Douai (Apr. 9, 1986).

<sup>90</sup> MICHEL PRIEUR, DROIT DE L'ENVIRONNEMENT 591 (1984) [hereinafter PRIEUR], *see also* RAPPORT SERVANT, *supra* note 32, at 21.

<sup>91</sup> L'ENVIRONNEMENT INDUSTRIEL ET AGRICOLE, *supra* note 87, at 23. The availability of financial assistance to apply new technologies is also an important factor in the success of such a regulatory scheme. This factor will be discussed later in this article.

study) for industrial and commercial facilities under French law contribute to significant improvement in hazardous waste minimization in the immediate future.

2. The German Approach: Hazardous Waste Minimization as a Condition for Issuance of Environmental Permits—  
Development of Comprehensive Technical Standards for Waste Management

The Federal Republic of Germany offers several examples of a regulatory approach to hazardous waste minimization that uses environmental permitting processes to affect waste production, recycling and reuse. Experience with this approach is still somewhat limited and additional variations of the approach are currently being developed.

*a. Minimization under the Dumping at Sea Act*

Under the Oslo Convention and the 1977 German Dumping at Sea Act,<sup>92</sup> the dumping or other disposal of hazardous waste at sea, including incineration, is subject to a license granted by the German federal authorities.<sup>93</sup> Under German law, this license will not be granted if there is an alternative method for disposing of the waste on land. The Federal Environmental Agency or Umweltbundesamt (UBA), which is responsible for implementation of the law, has interpreted land disposal to include recycling and reuse of the waste.<sup>94</sup> As part of its work in identifying, developing, and demonstrating new technologies to avoid and reduce hazardous waste production, the UBA seeks to identify proven technologies that can be used as an alternative to ocean incineration.

An example of how the UBA has attempted to use its authority under the Dumping at Sea Act is the denial of a license to one of the largest German chemical manufacturers to incinerate certain chlorinated hydrocarbons at sea.<sup>95</sup> The license denial was based on the

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<sup>92</sup> Goosmann Interview, *supra* note 42.

<sup>93</sup> No new approvals for ocean dumping have been granted since 1977. Incineration is the only method currently licensed for ocean disposal by the German government. See K. Komorowski, Problems Associated with Hazardous Waste in the Federal Republic of Germany Having Particular Regard to Research and Development, 18-19 (unpublished manuscript available from author).

<sup>94</sup> Goosmann Interview, *supra* note 41; Interview with H. Christian Nels, Chemical Engineer-Economist at the UBA, in Berlin (Apr. 21, 1986) [hereinafter Nels Interview].

<sup>95</sup> Goosmann Interview, *supra* note 42.

availability of an internal recycling technology used by a French chemical manufacturer. The French firm brought the technology to the attention of the UBA and offered to license it in Germany. On this basis, the UBA found that a land disposal alternative was available and denied the license for sea incineration.<sup>96</sup>

But the story does not end here. The German firm decided not to use the French technology but to develop a recycling technology to fit its own manufacturing process. In the interim allowed for development of this technology, the UBA identified a treatment facility in the Netherlands for the waste. However, the German firm refused to send a sample of its waste to the treatment facility on the grounds that this could reveal trade secrets. It also objected to any requirement to use a land alternative outside Germany. The matter of interim treatment during development of the recycling technology is now before the German courts. In the meantime, the German firm continues to incinerate the wastes at sea under a valid license.

Another example of the use of the Dumping at Sea Act is the denial of a license to a company that proposed ocean incineration at a rate of 200 DM per ton (about \$90). The UBA identified a land disposal method costing 400 DM per ton. Initially, the company considered waste minimization methods as a way to avoid the higher costs of land disposal. But ultimately the waste was shipped to Antwerp, Belgium and incinerated on a Liberian ship, beyond the reach of German law.<sup>97</sup>

The administration of the Dumping at Sea Act illustrates that the German government is capable of identifying technically and economically feasible technologies as part of a regulatory scheme to discourage disposal and foster minimization of hazardous waste. German experience also shows that the high cost of alternatives and the possibility of exports to another jurisdiction with less stringent regulations may undermine the effectiveness of such a scheme. Nevertheless, the Dumping at Sea Act has made marine treatment and disposal options more difficult and expensive for German industry. This in itself may encourage new efforts toward minimizing waste production.

#### *b. Minimization under the Emission Control Act*

Perhaps the most direct attempt to achieve hazardous waste minimization through a regulatory approach is the German Emission

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<sup>96</sup> *Id.*

<sup>97</sup> Nels Interview, *supra* note 94.

Control Act of 1974.<sup>98</sup> Under that Act, as amended in 1985, any facility requiring a license because of its emission of pollutants into the environment must be operated in such a way as to avoid or recycle its waste residues to the extent it is technically feasible and not disproportionately expensive to do so.<sup>99</sup> Before a license is granted, the applicant must show that it has examined all available possibilities for avoidance, reduction, and recycling of its wastes.

The Emission Control Act is enforced by the German states and by the regional or local officials acting under their authority. There seems to be general agreement on three conclusions about the waste minimization provisions of this law. First, the recent enactment of the law means there is little experience in enforcing its provisions.<sup>100</sup> One state official indicated that his state planned to enforce these provisions vigorously as part of an overall program to encourage minimization.<sup>101</sup> An industry representative expressed the opinion that enforcement of the provisions would likely involve negotiation of technical alternatives between industry and government.<sup>102</sup>

A second general conclusion about the Emission Control Act was that enforcement of the waste minimization provisions will require development and application of technical standards for industrial processes and methods of recycling and reuse. The UBA is assisting the states in developing information on alternative technologies and in reviewing and evaluating technical information submitted in license applications.<sup>103</sup> The information developed by the UBA will include a survey of available and proven technologies and technical standards for certain types of processes.<sup>104</sup> In carrying out this function, the UBA will use the results of demonstration projects it has supervised and will draw upon its experience as enforcement agency for the Dumping at Sea Act. The states, however, may still find it difficult to challenge industry arguments that technologies are not feasible or are too expensive.<sup>105</sup> States with research capabilities

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<sup>98</sup> Federal Emission Control Act of Mar. 15, 1974, BGBI.I 721 (W. Ger.).

<sup>99</sup> *Id.* Art. 5, § 1, as amended by Act of October 4, 1985, BGBI.I 1950. See *supra* note 41 and accompanying text.

<sup>100</sup> Interviews with Dr. Schmitt-Tegge at the UBA, in Berlin (Apr. 21, 1986) [hereinafter Schmitt-Tegge Interview]; Dr. Frank Andreas Schendel, Attorney, Environmental Department, Bayer A.G., in Leverkusen (May 6, 1986) [hereinafter Schendel Interview].

<sup>101</sup> Interview with H. Karl-O. Zubiller, Ministry of the Environment, State of Hesse in Wiesbaden (May 2, 1986) [hereinafter Zubiller Interview].

<sup>102</sup> Schendel Interview, *supra* note 99.

<sup>103</sup> Schmitt-Tegge Interview, *supra* note 99; interview with Dr. Hans Sutter at the UBA, in Berlin (May 21, 1986) [hereinafter Sutter Interview].

<sup>104</sup> Sutter Interview, *supra* note 103.

<sup>105</sup> Interview with Dr. Lutz Wicke at the UBA, in Berlin (Apr. 22, 1986).

similar to the UBA, such as Hesse and Rhineland-Westphalia, will be in a better position to identify appropriate technologies for waste minimization.

The third conclusion concerning the waste minimization provisions of the Emission Control Act is that regulation of this type is a necessary component of an overall approach to the minimization issue. Even the counselor to the conservative CSU Party faction in the Bundestag recognized that the market by itself will not bring about waste minimization and that legislative measures such as the Emission Control Act are necessary to influence the market.<sup>106</sup>

*c. Minimization as part of an integrated (cross-media) approach to environmental permitting in the State of Hesse*

The State of Hesse is currently in the final stages of developing an integrated regulatory approach to the control of air and water pollution and waste production in industries that use specific heavy metals in their manufacturing processes.<sup>107</sup> Hesse intends to expand this approach later to other industries, beginning with those producing pollutants or residues containing halogenated hydrocarbons. This approach is described as integrated or comprehensive because the objective is to minimize the adverse effects of all types of pollutants from a single source. Regulation of this type is also sometimes referred to as a "cross-media" approach because it attempts to avoid use of pollution control strategies that displace pollutants from one environmental medium to another (for example, from the air to the soil and groundwater).<sup>108</sup>

The first stage in this integrated or cross-media approach was a study of the quantities of metals such as mercury, lead, chrome, nickel, cadmium and copper used in industrial processes. This was followed by a study of the loadings of these metals in surface water resulting from industrial discharges and diffuse sources. Finally, the third stage will identify comprehensive strategies for pollution treatment and avoidance that will minimize discharges to air and water and minimize the production of waste.<sup>109</sup> Hesse plans to make vigorous use of its waste minimization authority under the Emission

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<sup>106</sup> Interview with Dr. Hüllmantel, Advisor to CDU/CSU Faction (majority coalition), in Bundestag, Bonn (Apr. 25, 1986).

<sup>107</sup> Zubiller Interview, *supra* note 101.

<sup>108</sup> For example, some air pollution control devices capture pollutants in a sludge which, if disposed improperly, may cause pollution of water. *Id.*

<sup>109</sup> The third stage was to be completed in Fall, 1986. *Id.*

Control Act as part of its comprehensive strategy. Under this approach hazardous waste minimization would become an explicit component of an industry's environmental permits. The Hessian strategy appears to be the kind of effort that will be required to put teeth into the waste minimization requirements of the Emission Control Act.

*d. Development of uniform technical standards for hazardous waste avoidance, treatment, and disposal alternatives*

Germany seems to be at the forefront in Europe in developing a comprehensive catalog of preferred alternative technologies for managing specific hazardous waste streams, with alternatives selected according to their environmental soundness. A draft of such a catalog has been developed by an inter-ministerial working group representing all eleven German states, with technical assistance provided by the UBA.<sup>110</sup> The development in Germany of uniform technical instructions for the proper disposition of specific types of hazardous waste, including techniques for recycling and reuse, is an important component of a waste minimization strategy for several reasons. First, for those wastes with identified options for recycling and reuse, there will be an explicit basis to require waste producers to use those options under the Emission Control Act. Second, to the extent that environmentally sound management methods required by the technical instructions are more expensive than current methods, the increased management costs will provide an additional incentive for waste minimization. And third, the implementation of uniform comprehensive technical guidelines in Germany could lead to greater uniformity of technical standards for waste management in the European Community, reducing the incentive for waste producers to use cheaper, less environmentally sound management methods by sending the waste to another country.<sup>111</sup>

3. The Netherlands: Integrated Permitting with Technical and Financial Assistance; Hazardous Waste Landfill Ban

In the Netherlands, legislation is expected to take effect in 1988 that will require industrial facilities subject to environmental permits to obtain a single, integrated permit for air and water emissions and

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<sup>110</sup> Interview with H. Jung, and H. Platz, Ministry of the Environment, State of Rhineland-Palatinate in Mainz (May 5, 1986) [hereinafter Jung & Platz Interview].

<sup>111</sup> Yakowitz Interview, *supra* note 74.

waste management.<sup>112</sup> This integrated permit requirement will be part of an overall government strategy to improve waste management and encourage minimization of waste production. The other major elements of this strategy are to assist in the establishment of a better waste management infrastructure, and financial support for the development and implementation of new waste minimization technologies.<sup>113</sup> The Dutch approach to waste minimization differs from that in other European countries in that it emphasizes better "housekeeping" practices within industrial plants.<sup>114</sup> Under the integrated permitting approach, the government can insist that industries eliminate inefficient and sloppy industrial practices that result in higher production of waste.<sup>115</sup> At the same time, the government can offer financial assistance to industries so that they can develop and implement new waste minimization techniques.<sup>116</sup>

In the view of Dutch officials, the initial high cost of administering an integrated permitting system coupled with technical and financial assistance for low waste and non-waste production technologies is offset by other benefits of the strategy. When pollution and waste control are built into production methods, compliance with pollution and waste limitations becomes a normal and necessary part of maintaining an efficient operation. Since the financial success of an industry depends on maintaining its production, the industry will have a strong incentive to continue to minimize its pollution and waste production. In addition, when non-polluting methods are used, there are no end-of-pipe treatment methods subject to failure, removal or circumvention. Thus, regulatory enforcement costs and environmental risks are reduced.<sup>117</sup>

The general ban on land disposal of hazardous waste in the Netherlands acts as another potential regulatory tool for encouraging minimization and avoidance. Under Article 31 of the Chemical Waste Act, land disposal or dumping of hazardous waste is forbidden.<sup>118</sup>

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<sup>112</sup> Interview with M. L. Bonney, Environment Inspectorate, Province of South Holland in Rotterdam (May 21, 1986). This approach will probably apply primarily to larger industrial installations. Interview with H. Hazewinkel, Ministry of Housing, Physical Planning and Environment in Leidschendam (May 20, 1986) [hereinafter Hazewinkel Interview].

<sup>113</sup> *Id.*

<sup>114</sup> Housekeeping practices related to waste management might include separation of different hazardous waste streams, elimination of leaks, spills and other losses of chemicals during a production process, and more efficient organization and maintenance of an industrial operation to avoid unnecessary waste.

<sup>115</sup> Hazewinkel Interview, *supra* note 112.

<sup>116</sup> *Id.*

<sup>117</sup> *Id.*

<sup>118</sup> NETHERLANDS PROGRAMME, *supra* note 45, at 20. This programme is a description of



However, exemptions can be granted for particular wastes for which there are no other suitable alternatives for disposal, treatment, recovery or reuse.<sup>119</sup> Process changes that can eliminate production of a waste may also be considered as an alternative to land disposal.<sup>120</sup> In addition, when an exemption is granted to a waste producer to allow land disposal, the producer is required to do research into process changes or other alternatives for treatment or reuse of the waste.<sup>121</sup>

The effectiveness of the Netherlands' land disposal ban as a method of encouraging hazardous waste minimization is diminished by several important factors. First, export of waste to other countries is relatively easy. Second, waste producers are allowed to store hazardous waste at the site of generation for an indefinite period. Both of these alternatives may be cheaper for an industry than developing ways to change production processes or to reuse, recycle or recover hazardous waste.<sup>122</sup> In addition, the government tends to grant temporary exemptions from the ban and to extend them when industry is slow to implement alternatives.<sup>123</sup> The effectiveness of a land disposal ban also depends to a large extent on financial incentives to develop new alternatives and on aggressive government identification of already-demonstrated technical alternatives.<sup>124</sup>

#### 4. Regulation of Products Containing Hazardous Substances

Two countries, Germany and France, have enacted laws authorizing regulation of products which contain hazardous substances and which could cause environmental problems when the products are being discarded and disposed. The German law was adopted in August, 1986, as part of the Fourth Amendment to the Waste Act. Together with provisions to regulate the sale and recovery of containers, the provisions concerning hazardous materials in products

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the Dutch government's chemical waste policy for 1985 and an indication of what the policy will be in the four years following 1985. It should be noted that, despite the current land disposal ban, the Netherlands is developing a new integrated treatment and disposal facility for hazardous waste near Rotterdam. This facility will include land disposal for a limited set of wastes. *See id.* at 59-60.

<sup>119</sup> There are currently about ten exemptions in effect. Henselmans Interview, *supra* note 47.

<sup>120</sup> *Id.*

<sup>121</sup> NETHERLANDS PROGRAMME, *supra* note 45, at 89.

<sup>122</sup> Henselmans Interview, *supra* note 47.

<sup>123</sup> *Id.*

<sup>124</sup> *Id.* In Henselmans' view, the Dutch government has not been aggressive enough in identifying and developing alternatives to land disposal. *Id.*

were the subject of vigorous debate during the formulation of the Fourth Amendment. The French law, which is part of the 1975 Framework Law on Hazardous Waste, provides similar authority but apparently has never been applied.

*a. Fourth Amendment to the Waste Act: the German approach*

The recently enacted Fourth Amendment to the German Waste Act<sup>125</sup> includes a section which authorizes the federal environmental authorities to regulate the way that certain products containing hazardous substances may be offered for sale and how they must be handled when disposed after use. Under Article 1, Section 14(1) of the amendment, there are four requirements that may be applied to such products in order to avoid or reduce the presence of hazardous substances in waste.<sup>126</sup> First, the government can require the product to be labelled to show that it contains hazardous substances and must be managed in a specific way when discarded. The label may state that the product must be returned to the producer or to others who have a license to dispose of it. Second, persons disposing of such products can be required to separate the discarded products from other wastes and to see that they are being properly collected, transported, treated and disposed. Third, sellers can be prohibited from selling certain products containing hazardous substances unless they provide a place for the discarded products to be returned or charge a deposit on the sale. Fourth, the government can prohibit the sale of such products except for special purposes or under special conditions, including provision of proper methods for disposing of the discarded product.

These provisions are designed to achieve two related purposes: first, to assure that products containing hazardous substances will be separated from other kinds of waste (including domestic solid waste) when they are discarded so that the waste from these products is properly managed; and second, to encourage manufacturers of products to avoid or reduce the use of hazardous substances in their products in the first place in order to avoid labelling requirements, deposits, and restrictions on sale and use of the product.<sup>127</sup>

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<sup>125</sup> See *supra* note 37 and accompanying text.

<sup>126</sup> The Author acknowledges the assistance of H. Wigand Kahl, Deputy Director, City of Munich Environmental Board, in translating the provisions of Section 14(1). Interview with H. Kahl, at St. Paul, Minnesota (September 17, 1986).

<sup>127</sup> The author of the Fourth Amendment stated that one of the purposes of that amendment is the avoidance or reduction of hazardous substances in products. Interview with H. Bernd

The new German law recognizes that it is not enough to encourage industry to avoid or reduce the amount of hazardous waste in its by-products and residues; industry must also begin to produce products that are compatible with a clean and healthy environment.

While it is too early to say how this new authority under the Fourth Amendment will be exercised, or how successful it will be in avoiding or reducing hazardous constituents in discarded product waste streams, there is reason to believe that some manufacturers will choose to alter the composition of their products rather than be forced to comply with regulations on their sale and use. During the parliamentary debate on the Fourth Amendment, the UBA was asked by the German government to prepare examples of the types of regulations that could be adopted under Article 1, Section 14(1). The UBA quickly prepared eighteen examples including labelling of plastic containers containing polyvinyl chloride (PVC). The detergent industry, which uses PVC containers to package products such as dishwashing and laundry detergent, was quick to respond to the UBA examples. The industry suggested that they would prefer to withdraw the PVC packages voluntarily rather than be subject to a labelling requirement, and that they were already working on new packaging materials that eliminate the use of PVC.<sup>128</sup> Another of the examples prepared by the UBA concerned the use of lead caps on wine and liquor bottles, a major source of lead in domestic waste. When this proposal was published in a wine producer's trade magazine, the producers began ordering fewer lead caps for their bottles. In the process, the producers discovered that lead costs two to three times as much as other alternative materials such as aluminum.<sup>129</sup>

These examples illustrate one of the strategies underlying the new requirements of the Fourth Amendment, that is, to use the requirements as an incentive for voluntary actions by industry. Particularly in the field of consumer products, where there is a competitive market and producers are concerned with their public image, removal of hazardous substances from a product may be highly preferable to the imposition of labelling or other requirements that call into question the safety of the product. It is clearly a part of the German approach to use the Fourth Amendment as a bargaining

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Schmidbauer, Bundestag Member (Apr. 24, 1986). A member of the opposition SPD party agreed that the amendments, if properly enforced, would encourage technical innovation and reduction of the amount of hazardous waste requiring disposal. Interview with Dr. Leisel Hartenstein, Bundestag Member (Apr. 25, 1986) [hereinafter Hartenstein Interview].

<sup>128</sup> Interview with Dr. Jürgen Orlich at the UBA, in Berlin (April 22, 1986).

<sup>129</sup> *Id.*

chip with industry to encourage voluntary changes in production processes to reduce or eliminate the use of hazardous substances in their products.<sup>130</sup>

*b. Product regulation under the 1975 French Framework Law*

Title II, Article 6 of the 1975 French Framework Law<sup>131</sup> states that the French government may regulate, or if necessary may prohibit, the manufacture, distribution or sale of products which are a source of hazardous waste in order to facilitate proper management of the waste. The regulations may require that producers, importers or distributors of such products, or of the materials composing the products, provide or contribute to the management of wastes that result from the products. Finally, persons who collect wastes resulting from such products may be required to deliver the wastes to facilities designated by the government under specially defined conditions. The Author was not informed of any instance in which these provisions have been applied by the French government.

5. Requiring Use of Specific, Approved Waste Management Facilities

Government designation of the specific waste management facilities that may be used by waste producers to recycle, treat, or dispose of their wastes is a good example of government regulation that may indirectly encourage hazardous waste minimization although not primarily designed for that purpose. Facility designation is generally designed to assure that government-owned or subsidized facilities receive sufficient amounts of waste to operate effectively, or to assure that certain preferred treatment and disposal methods will be used by waste producers. The primary examples of what might be called hazardous waste "flow control" laws are found in Germany and France. Several German states, including Bavaria, Hesse, and the Rhineland-Palatinate, either have established or are planning integrated hazardous waste treatment and disposal facilities owned and operated jointly by the state and private industry. Waste pro-

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<sup>130</sup> The German government intends to seek voluntary agreements with industry on goals and quotas to meet the objective of the Fourth Amendment. If these quotas are not met, or if agreements cannot be negotiated, the government would exercise its powers to regulate matters such as product labelling, deposits on product purchases, and special requirements for discarded products. Interview with H. Lumpe, Federal Ministry of the Interior, Bonn, (Apr. 30, 1986).

<sup>131</sup> Law 75-633 tit. II, art. 6. of July 15, 1975, (Framework Law).

ducers in these states are generally required to deliver their hazardous waste to these facilities.<sup>132</sup> In France, flow control has been instituted only for the recovery of used oil. There is a continuing debate in France about the advisability of implementing flow control authority for hazardous waste management.<sup>133</sup>

Requiring that hazardous waste be delivered to particular facilities can have a strong indirect effect on hazardous waste minimization. Such regulations, when tied to the use of new, state-of-the-art recycling, treatment and disposal alternatives, can result in higher waste management costs to producers. Flow control may also eliminate the possibility of using cheaper management alternatives outside of the jurisdiction that has imposed flow control. By raising the cost of treatment and disposal and eliminating cheaper and less desirable alternative facilities, flow control can provide economic incentives for generators to reduce or avoid the production of hazardous waste. Government can also use flow control to enforce uniform technical standards for hazardous waste treatment and disposal by designating only facilities that meet those standards.<sup>134</sup>

*B. Financial and Technical Assistance: Positive Economic Incentives for Hazardous Waste Minimization*

The previous section of this article examined regulatory approaches to encourage hazardous waste minimization. Government and other institutions can also influence industry decisions about waste minimization by affecting the cost of waste minimization and other waste management alternatives. This section of the article examines European programs to provide positive economic incentives to encourage hazardous waste minimization. In particular, this section examines how government and other institutions in Europe promote development and implementation of new technologies and

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<sup>132</sup> Jung & Platz Interview, *supra* note 110.

<sup>133</sup> The potential benefits cited for flow control in France are the creation of a stable waste market for waste management facilities and the ability of waste producers to reduce their liability for damages by delivering the waste to a facility approved by the government. Combrouze Interview, *supra* note 26. See *infra* notes 259–82 and accompanying text.

<sup>134</sup> Interview with Dr. Klaus Komorowski, Senior Staff Member, Federal Ministry for Research and Technology, in Bonn (May 7, 1986). According to environmental officials of the Rhineland-Palatinate, the only effective way that Germany is able to insist on proper treatment and disposal of hazardous waste is to require waste producers to use the facilities established with public support. Jung & Platz Interview, *supra* note 110. Henselmans Interview expressed the view that flow control is needed in the Netherlands to assure the use of proper waste management facilities but that the Dutch government will not use this measure, *supra* note 47.

methods to minimize hazardous waste through programs of financial and technical assistance to waste producers. Government can also promote waste minimization through negative economic incentives primarily by increasing the cost of producing, treating and disposing of hazardous waste. Government actions can affect waste management costs by affecting the availability and operating requirements of waste management facilities,<sup>135</sup> imposing liability on waste producers for injuries attributable to the waste, and levying fees and taxes on waste production, treatment or disposal. Negative economic incentives for waste minimization will be discussed in the next section of the article.

There are two methods to encourage industry to adopt management and technological changes necessary to minimize the production of hazardous waste. One way is for government to assist industry to develop and demonstrate the application of new technologies by sharing in the capital and operating costs of such projects. A second method is to provide information and advice about organizational and technical changes that can be instituted by industry to improve the management of hazardous waste and minimize the amounts that require treatment or disposal. The second method, generally referred to as technical assistance, encompasses such varied activities as education, technical reviews or audits of an industry's waste management practices, information sharing, technology transfer, and waste exchanges.<sup>136</sup>

There is considerable experience in Europe with both government financial assistance programs and public and private technical assistance programs designed to improve the state of hazardous waste management and minimize future hazardous waste production. Fairly well-developed financial assistance programs designed to encourage waste minimization are operating in Germany, the Netherlands and France, and under the auspices of the Commission of the European Community. Technical assistance is provided by a variety of governmental, private, and hybrid organizations in Germany including the UBA, individual states, industry trade associations, and

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<sup>135</sup> See *supra* notes 13-61 and accompanying text.

<sup>136</sup> A waste exchange is a service designed to help generators of particular wastes find other industries that will buy, trade, or otherwise accept those wastes for re-use in their production process. Waste exchanges are often operated through regular newsletters listing offers and demands for identified waste streams by industries that are members of the exchange. Some waste exchanges actively seek out firms willing to accept wastes made available by their members. See, e.g., GUIDE POUR L'ÉLIMINATION ET LA VALORISATION DES DÉCHETS INDUSTRIELS 95 (2d ed. 1984).

chambers of commerce. In France similar services are provided by ANRED, industrial associations, and private engineering firms. In addition, the Commission of the European Community is supporting research by an English consulting firm on the development of a community-wide program for hazardous waste technical assistance and technology transfer.

### 1. Government Financial Assistance: General Considerations

Government programs of financial assistance to industry for demonstration of new technologies to minimize hazardous waste generally have three goals: to foster development of new clean technologies, to make the technologies widely available to industry, and to build a foundation for stricter regulation of waste production. To accomplish these goals, government offers to share the financial risk of demonstration projects with industry. This introductory section discusses the risk-sharing function of financial assistance programs and the manner in which different programs address the goals of raising regulatory standards and making new technologies available to other industries.

#### *a. Government risk-sharing*

Government financial assistance to private industry to encourage adoption of technologies to minimize production of hazardous waste generally is based on the recognition that industries incur risks when adopting new technologies. Those risks include: technical risks (the technology may not work or it may not fit with other phases of production); economic risks (the technology may turn out to be too costly); and social risks (the use of a new technology may encounter resistance from employees or even from managers). Government financial assistance is offered in order to reduce or share the risks of implementing a new technology to minimize production of hazardous waste.<sup>137</sup> While the risks of technological change are felt by both large and small industries, the introduction of new technologies may be more difficult for small businesses because of their relative lack of technically trained personnel, inability to raise capital for new

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<sup>137</sup> Interview with Mme. Florence Pétillot, Chief of Clean Technologies Mission, Ministry of the Environment, in Paris (Mar. 27, 1986) [hereinafter Pétillot Interview]; Hazewinkel Interview, *supra* note 90; Interview with Jean-Marie Junger, Chief of Waste Management and Clean Technologies, DGXI, Commission of the European Community, in Brussels (April 8, 1986) [hereinafter Junger Interview].

investment, and lack of understanding of the availability and benefits of new technologies.<sup>138</sup> But government assistance for waste minimization in Europe is not limited to small industries. For example, in Germany the UBA considers that if a new technology is transferable to other industries, government financial assistance to demonstrate the technology is justified even if the industry demonstrating it is a large, well-established company.<sup>139</sup>

*b. Raising regulatory standards*

Government financial assistance to develop and demonstrate new technologies to minimize hazardous waste can play an important role in setting and enforcing more stringent technical requirements for waste producers. For example, in France, the River Basin Finance Agencies may provide grants to install new equipment in a factory on the condition that, while using the new equipment, the factory will meet higher regulatory standards for its water pollution discharges than would otherwise be required.<sup>140</sup> In Germany, the UBA uses technical knowledge gained from subsidized demonstration projects to show that new technologies to reduce, avoid or recycle hazardous wastes are technically and economically feasible alternatives under laws such as the Dumping at Sea Act and Emission Control Act.<sup>141</sup> The same knowledge could also be used in France to evaluate the adequacy of waste management procedures proposed for a new industrial facility subject to an impact study and government authorization.<sup>142</sup> While it may be advantageous to government regulators to learn about new technologies, the fear of imposition of more stringent regulations can also be a factor in discouraging industry from seeking government assistance to demonstrate new techniques.<sup>143</sup>

*c. Making new technologies available to other industries*

One of the primary goals of government assistance in developing waste-minimizing technologies is to make the new technologies widely available to other industries in order to achieve as much waste reduction as possible. Industrial firms, however, are generally

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<sup>138</sup> Pétillot Interview, *supra* note 137.

<sup>139</sup> Nels Interview, *supra* note 94.

<sup>140</sup> Lemarchand Interview, *supra* note 34.

<sup>141</sup> Nels Interview, *supra* note 94. See *supra* notes 36–41 and accompanying text.

<sup>142</sup> See *supra* notes 75–91 and accompanying text.

<sup>143</sup> Junger Interview, *supra* note 137.



reluctant to share their new technologies, especially with competitors in the same field. Requiring such information-sharing may discourage a firm from participating in grant and loan programs to demonstrate new technologies.<sup>144</sup> The availability of a newly demonstrated technology may depend on who holds the legal right to exploit it. Under the demonstration grant program of the Commission of the European Community, the industry that develops the new process is allowed to take a patent on it, but is required to make the patented process available to others.<sup>145</sup> In order to protect the trade secrets of its grant recipients, the Commission keeps all project information confidential until a final report is issued.<sup>146</sup> For similar grant projects in Germany, the UBA requires the grantee to make the patented process available at market rates. However, if the UBA grant covers more than 50% of the project cost, the patent belongs to the UBA.<sup>147</sup>

## 2. Specific Programs of Financial and Technical Assistance

### *a. France*

A description of French programs to encourage development and implementation of technologies to minimize hazardous waste must begin with the Clean Technologies Mission of the Ministry of the Environment. The Clean Technologies Mission promotes industrial methods that avoid the creation of pollution at the source, as opposed to so-called "end-of-pipe" pollution control methods that treat and purify pollution after it is created. Financial assistance for non-polluting technologies in France is also available from the River Basin Finance Agencies, ANRED, ANVAR (National Agency for Resource Recovery and Research), and the French Agency for Energy Control.<sup>148</sup> Technical and informational assistance to support hazardous waste minimization in France comes from a variety of public agencies including the Ministry of the Environment, the River Basin Finance Agencies, ANRED, and the DRIR, as well as private organizations like APORA (Industrial Association for Pollution Prevention for the Rhone-Alpes Region).

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<sup>144</sup> *Id.*

<sup>145</sup> *Id.*

<sup>146</sup> *Id.*

<sup>147</sup> Nels Interview, *supra* note 94.

<sup>148</sup> MINISTÈRE DE L'ENVIRONNEMENT, GUIDE POUR L'ÉLIMINATION ET LA VALORISATION DES DÉCHETS INDUSTRIELS 97 (2d ed. 1984).

Organized as a special arm of the Division of Pollution Prevention, the Clean Technologies Mission acts primarily as a source of information and catalyst for technical change. In a major publication describing ninety-seven clean technologies already in use or under development by French industry, the Clean Technologies Mission identifies three levels of activity designed to reduce or avoid pollution: (1) improved management of the flows of water, energy, raw materials, end-products and residues in existing production processes in order to minimize the amount and danger of the pollution created by the process; (2) modifications to production processes to provide recycling, reuse, and recovery of materials that would otherwise contribute to the creation of pollution; and (3) substitution of new production processes that do not create pollution in the first place.<sup>149</sup> Up to now, the Clean Technologies program has concentrated on preventing air and water pollution. Approximately 40 million Francs (about \$5.7 million) was made available in 1985 by the Clean Technologies Mission to support private investment in new techniques to avoid pollution.<sup>150</sup> About ten percent of the projects sponsored by the program have involved prevention of industrial or hazardous waste.<sup>151</sup>

Probably the primary sources of financial assistance to industry for pollution control in France are the six River Basin Finance Agencies. Assistance for waste minimization projects is a relatively new component of the financial assistance offered by these agencies.<sup>152</sup> The River Basin Finance Agency for Artois-Picardie, a highly industrialized area in northern France, has provided about 1 billion Francs (about \$140 million) in grants and operating subsidies to industry for pollution control and avoidance between 1969 and 1985. About one-third of these grants were to assist with process changes and two-thirds were for end-of-pipe pollution control equipment.<sup>153</sup> Beginning in 1985, this Agency will make grants of up to 40% and loans of up to 30% of qualified capital investments to control water pollution. The Agency may pay a larger share of costs for investments designed to minimize or avoid creation of pollution, including the minimization of hazardous waste.<sup>154</sup>

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<sup>149</sup> MINISTÈRE DE L'ENVIRONNEMENT, *LES TECHNIQUES PROPRES DANS L'INDUSTRIE FRANÇAISE* 12-13 (1981).

<sup>150</sup> Lemarchand Interview, *supra* note 34.

<sup>151</sup> Raak Interview, *supra* note 24.

<sup>152</sup> In the past, the agencies have financed the installation of water pollution control equipment and process modifications designed to reduce water pollution. They have also subsidized the cost of waste transportation, treatment and disposal. Raak Interview, *supra* note 24.

<sup>153</sup> Raak Interview, *supra* note 24.

<sup>154</sup> *Id.*

Some River Basin Finance Agencies also offer to share the cost of professional pollution audits of industrial plants. For example, one agency offers to pay 50% of the cost of a pollution audit or up to 15,000 Francs (about \$2,500), when the audit is performed by a firm approved by the agency.<sup>155</sup> The River Basin agencies can also promote waste minimization by requiring it as a condition of making grants for more traditional pollution control equipment.<sup>156</sup>

ANRED provides financial assistance for research, development, and implementation of technologies to minimize hazardous waste production.<sup>157</sup> ANRED also acts as a source of technical information on hazardous waste management, and is beginning to provide a waste audit service to private industry.<sup>158</sup> Financial assistance from ANRED may be provided in the form of grants or reimbursable assistance, depending upon the success of the project. Reimbursable assistance is provided at a low rate of interest and may cover up to 35% of the cost of certain projects.<sup>159</sup> ANRED spent about 50 million Francs (over \$7 million) in 1985 on financial assistance to all types of projects. Most of these projects concerned the development or evaluation of methods to treat, recover, reuse or recycle wastes; very few projects seem to have been devoted to waste minimization.<sup>160</sup>

Assistance to industry in improving industrial waste management in France is also provided by private organizations such as APORA. APORA is supported by a large number of industrial organizations and individual companies located in the Rhone-Alpes region, the most important industrial region in France after Paris.<sup>161</sup> Four

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<sup>155</sup> ASSOCIATION POUR LE PRÉVENTION DES POLLUTION INDUSTRIELLES ET LA PROTECTION DE L'ENVIRONNEMENT RHÔNE-MOYEN, INDUSTRIES ET EAU 18 (1986).

<sup>156</sup> Fidon Interview, *supra* note 81.

<sup>157</sup> Lemarchand Interview, *supra* note 34.

<sup>158</sup> An electronics factory in Angers will be the first industry to receive such an audit from ANRED in 1986. Lemarchand Interview, *supra* note 34.

<sup>159</sup> AGENCE NATIONALE POUR LA RÉCUPÉRATION ET L'ÉLIMINATION DES DÉCHETS (ANRED), RAPPORT D'ACTIVITÉ (1985).

<sup>160</sup> *Id.* at annexe 1.

<sup>161</sup> APORA is supported by the Rhône-Alpes Regional Chamber of Commerce and twelve sub-regional Chambers; by trade associations representing the many kinds of heavy industry and manufacturing activities located in the region; by eight Department-level professional organizations representing employers; and by 300 individual dues-paying industrial members. It should be noted that in France all companies are required by law to be members of a chamber of commerce and that the chambers have statutory obligations to represent and serve their members. See Association Environnement de l'Industrie Rhône-Alpes (APORA unpublished factsheet available from author) [hereinafter APORA Factsheet]; and interview with M. René-Pierre Furminieux, Secretary-General of APORA, in Lyon (Apr. 1, 1986) [hereinafter Furminieux Interview].

professionals serve the technical needs of APORA, including two chemists or chemical engineers, a specialist in water, and a specialist in food and agricultural industries.<sup>162</sup> Among the services offered to industry by APORA are an industrial waste exchange, diagnostic services with respect to all types of pollution prevention and control problems, and assistance in finding regulatory, technical and financial solutions to these problems.<sup>163</sup> APORA also circulates a regular newsletter, sponsors conferences and seminars, and publishes technical guides. Industries that are members of APORA receive basic services free of charge. For more complex problems fees may be charged for the assistance, which may include the use of outside professional consultants.<sup>164</sup> APORA does not provide financial support for technical research or demonstration projects, but attempts to maintain communication links with research agencies and to inform its members about technical developments and opportunities for grants, loans, and technical aid from other sources.

Because it is supported and directed by industry, APORA enjoys a high degree of credibility with those it serves. APORA is trusted to understand industrial conditions and to provide competent assistance in solving pollution problems without penalizing industry for its failures. Thus, industry is likely to give serious consideration to the information and advice which APORA provides. Improved hazardous waste management, including waste minimization, is a very important component of APORA's services to its members.<sup>165</sup>

#### *b. Germany*

The primary agency providing financial assistance for developing and implementing new technologies to minimize hazardous waste in Germany is the Federal Environmental Agency or UBA. The UBA is active and influential in the development and implementation of new federal environmental legislation and provides a substantial amount of financial assistance for research, development and demonstration of new technologies to control pollution.<sup>166</sup> Included in this program are projects to demonstrate techniques to avoid, recover,

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<sup>162</sup> Furminieux Interview, *supra* note 161.

<sup>163</sup> APORA Factsheet, *supra* note 161.

<sup>164</sup> *Id.*

<sup>165</sup> APORA has produced a number of surveys, reports and technical guides related to hazardous waste management in the Rhone-Alpes Region. It has also provided financial and technical support to the establishment of new treatment and disposal facilities in the Region.

<sup>166</sup> Nels Interview, *supra* note 94.

recycle and reuse industrial waste. Funds for these demonstration projects come primarily from the Federal Ministry of Research and Technology, but projects are selected, administered, and evaluated by the UBA.<sup>167</sup>

The UBA uses financial assistance as an incentive to industry to adopt new technologies that may be costlier than existing treatment and disposal alternatives, or that entail economic or technical risks for those adopting them. However, this is not the sole purpose of UBA's support of demonstration projects. The UBA also uses demonstration projects to define state-of-the-art technologies in waste avoidance, recycling, treatment and disposal.<sup>168</sup> Knowledge of these technologies can then be used by the UBA and the German states in enforcing waste avoidance and recycling requirements. For example, when new waste avoidance technologies are demonstrated to be technically and economically feasible, the UBA can deny an application for a permit to dispose of waste at sea under the Dumping at Sea Act and can require industry to use the newly demonstrated technology.<sup>169</sup> The UBA can also use information about state-of-the-art technology to advise and assist German state authorities in evaluating license applications for new industrial facilities under the Emission Control Act.<sup>170</sup> State authorities may withhold a license if the industry fails to use technically and economically feasible technologies that are available to minimize its production of waste.<sup>171</sup>

Through its work on demonstration projects, the UBA has found that the technical answers to waste avoidance and recycling problems are often complex and require highly individualized or custom-made solutions. It may be difficult to formulate generalizations about waste avoidance techniques until a large number of individual demonstration projects are completed and evaluated.<sup>172</sup> Examples of demonstration projects assisted by the UBA include: a project to

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<sup>167</sup> *Id.*

<sup>168</sup> *Id.*

<sup>169</sup> Dumping at Sea Act, February 11, 1977, BGBI.I 1977, S.165, as amended by Act of May 10, 1978, BGBI.I, S.613.

<sup>170</sup> Federal Emission Control Act, March 15, 1974, BGBI.I 721 (W. Ger.).

<sup>171</sup> See *infra* notes 98-99 and accompanying text. The UBA has found that industry is slow to act on new technical information, especially when action requires a change in the methods of production. Even when new techniques are economically feasible or profitable, the UBA has found that industry may not make changes unless forced to do so by regulation. Thus the UBA believes that regulations such as the waste avoidance and recycling requirements of the Emission Control Act are necessary to make sure that industry uses new techniques that have been demonstrated. Sutter Interview, *supra* note 103.

<sup>172</sup> Goosmann Interview, *supra* note 42.

develop a new metal-plating process that reduces waste by 95%; a closed system for the reuse of chlorinated solvents; and a technique for separating metals from mixed metal sludges now requiring disposal.<sup>173</sup>

The money made available by the UBA for waste research and demonstration projects comes from two sources. In 1985, the Ministry of Research and Technology provided about 51 million Deutsch Marks (D. M.)<sup>174</sup> (about \$23 million) for research and demonstration projects concerning all waste issues. Of this amount, about 6 million D. M. (\$2.75 million) went to universities for grants covering 100% of the cost of research grants, and 45 million D. M. (\$20.25 million) was used for matching grants to industry for the capital and operating costs of demonstration projects. In 1985, the UBA sponsored forty-five demonstration projects concerning waste issues, of which twelve involved new waste avoidance technologies.<sup>175</sup>

In addition to receiving grant money from the Ministry of Research and Technology, the UBA also received money from the Ministry of the Interior (jurisdiction of environmental matters has subsequently been moved to a new Ministry of Environment, Nature Protection and Reactor Safety), amounting to about 120 million D. M. (\$54 million) in 1985, to develop new technologies capable of exceeding regulatory requirements in all areas of pollution control. Of this amount, about 15 million D. M. (\$6.75 million) was made available by the UBA for matching grants to demonstrate new waste recycling and treatment technologies.<sup>176</sup>

In deciding whether a demonstration project is eligible for grant assistance, the UBA considers three criteria: first, whether the project involves risks which are appropriate for government to share with the industry carrying out the demonstration; second, whether the technique will be transferable to other industrial plants; and third, whether the project would not be undertaken at all without government assistance.<sup>177</sup> Matching grants can cover from 10 to 100% of the capital and operating cost of a project, but the average grant is for 50% of the cost.<sup>178</sup> Grant contracts provide that if the grantee

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<sup>173</sup> Sutter Interview, *supra* note 103.

<sup>174</sup> Nels Interview, *supra* note 94. The Deutsch Mark (abbreviated D.M.) is the German unit of currency.

<sup>175</sup> For a summary of all projects in solid waste technologies up to 1985, see DER BUNDESMINISTER FÜR FORSCHUNG UND TECHNOLOGIE, PROJECT MANAGEMENT-SOLID WASTE: PROJECTS 1978-1985, (4th ed., July 1985).

<sup>176</sup> Nels Interview, *supra* note 94.

<sup>177</sup> *Id.*

<sup>178</sup> *Id.*

continues to use the equipment after the demonstration period it must repay 50% of the current value of the equipment. If the demonstrated technique produces a profit for the grantee, the full grant must be repaid. Grant repayment can be made in installments.<sup>179</sup>

In addition to grant funds administered by the UBA, other types of government financial assistance are available in Germany for demonstration of new technologies.<sup>180</sup> The Ministry of Economy and Commerce offers low interest loans, tax incentives, and subsidies for such demonstration projects. This aid is offered to develop technology that can be used by other industries to reduce pollution or production of waste. The subsidy generally covers one-fourth to one-third of the total capital cost for the new technology. The Federal Ministry of the Environment also offers financial assistance for environmentally related capital improvements in addition to assistance provided through the UBA. According to state environmental officials, there is enough financial assistance available in Germany to provide significant help to any firm that is serious about making environmental improvements.<sup>181</sup>

Technical assistance to hazardous waste generators is provided by a variety of public and private organizations in Germany, including the states, the Association of German Chemical Manufacturers, private consulting firms, and chambers of commerce. Except for maintaining a list of private consultants and publishing and distributing technical reports, the UBA does not directly provide technical assistance to private industry. However, the UBA has made an agreement with the State of Rhineland-Palatinate to support a project providing information about new and improved technologies to small and medium-sized industries. Private consultants will be used to provide the assistance and will be paid in equal shares by the UBA, the state, and industry. The program is expected to provide the services of five consultants for a two year period at a cost of 1 million D. M. (\$450,000).<sup>182</sup>

Individual German businesses may also be able to obtain technical assistance on waste issues from the chamber of commerce or trade association to which they belong.<sup>183</sup> For example, the Cologne Chamber of Industry and Commerce advises its members on the selection

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<sup>179</sup> *Id.*

<sup>180</sup> Jung & Platz Interview, *supra* note 110.

<sup>181</sup> *Id.*

<sup>182</sup> Schmitt-Tegge Interview, *supra* note 99.

<sup>183</sup> Nels Interview, *supra* note 94. German chambers of commerce are patterned on the French model. See *supra* note 161 and accompanying text.

of new technologies and sources of financial assistance.<sup>184</sup> The Chamber may bring together individual companies and technical staff from universities or private consultants to work on applications of new technology to improve environmental protection. Financial aid for such projects can be channeled from the Federal Ministry of Research through the Chamber to the affected companies. The Chamber has found some industries are reluctant to use government financial assistance because the results of the projects are published and are thereby made available to competitors.<sup>185</sup>

The German Chemical Manufacturers Association is an example of a major trade association that provides technical assistance to its members on hazardous waste issues.<sup>186</sup> The Association established the first nation-wide chemical waste exchange in Germany. In addition, the Association provides some technical assistance on waste management to smaller member companies, and may recommend private consultants or request larger companies to assist in providing technical advice. The Association also publishes technical guidance on waste disposal facility design and supports an organization that advises private companies concerning cleanup of contaminated hazardous waste sites.<sup>187</sup>

Another example of a private source of technical assistance to hazardous waste generators in Germany is IWL, a private organization that advises and assists private industry on a wide range of environmental and pollution control issues.<sup>188</sup> Assistance from IWL includes advice concerning compliance with environmental laws and regulations, and concerning the proper management of industrial waste. The IWL was established by industries from various sectors of the economy and includes an advisory board made up of representatives of industry, government and universities.<sup>189</sup>

### *c. Netherlands*

In the Netherlands, hazardous waste minimization is encouraged through financial and technical assistance provided by the Ministry

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<sup>184</sup> Interview with H. Detlev Sachse, Vice-President of the Industrial Development Department, Cologne Chamber of Industry and Commerce, in Cologne (May 7, 1986) [hereinafter Sachse Interview]. See generally CHAMBER OF INDUSTRY AND COMMERCE OF COLOGNE: CIC COLOGNE AT THE ECONOMY'S SERVICE 7-8, 16-18 (1977).

<sup>185</sup> Sachse Interview, *supra* note 184.

<sup>186</sup> Interview with H. Werner Preusker, and H. Hartmut Skalicky, in Frankfurt (May 5, 1986) [hereinafter Preusker & Skalicky].

<sup>187</sup> *Id.*

<sup>188</sup> See INSTITUT FÜR GEWERBLICHE WASSERWIRTSCHAFT UND LUFTREINHALTUNG E.V..

<sup>189</sup> *Id.*



of Housing, Physical Planning and Environment.<sup>190</sup> Financial assistance is provided in two stages: first, grants of up to 60 or 70 percent of the cost are available for research and development of waste minimization techniques, including pilot scale demonstrations; second, grants of up to 25 percent of capital costs are available to implement waste minimization technologies. The government does not require repayment of these grants but does require that the technologies developed and implemented with government assistance be made available to other firms.<sup>191</sup> The Ministry currently has about 20 million guilder (Fl.)<sup>192</sup> (about \$8 million) available for research and 100 million guilder (Fl.) (about \$40 million) available for technologies to prevent pollution of all types. Of these totals, four to five million guilder (Fl.) (about \$1.6–2 million) is available for research on techniques of hazardous waste minimization and 25 million guilder (Fl.) (about \$10 million) is available for capital expenditures for that purpose.<sup>193</sup>

In addition to assisting in the development and implementation of new technologies, the Dutch Ministry also assists industry to demonstrate low-capital-cost process changes and housekeeping improvements that reduce the production of hazardous waste. The Ministry sponsors seminars and conferences to disseminate information and encourage participation in demonstration projects. When waste generators are small, marginally profitable businesses such as dry cleaners, the Ministry seeks to work with the generators as a group so that changes can be made by all businesses at the same time with minimal disruption or competitive disadvantages. The Ministry sometimes hires private consultants to survey the waste management methods of individual companies or to bring groups of businesses together to work on waste management improvements.<sup>194</sup>

In implementing its program of financial and technical assistance to promote waste minimization projects, the Dutch government seeks to overcome barriers such as lack of financial resources, management inertia and resistance to change, and lack of technical information, which impede implementation of new technologies and management methods. The government also emphasizes the relation of hazardous waste production to inefficiency in the use of raw ma-

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<sup>190</sup> Hazewinkel Interview, *supra* note 112.

<sup>191</sup> *Id.*

<sup>192</sup> The Guilder (abbreviated Fl.) is the Dutch unit of currency.

<sup>193</sup> Hazewinkel Interview, *supra* note 112.

<sup>194</sup> *Id.*

terials, poor housekeeping practices, and low product quality. Thus, in its efforts to encourage improved waste management and reduced waste production, the Dutch government stresses not only environmental protection but also the economic benefits to be gained by industries through increased operating efficiency and reduced cost of waste treatment and disposal. Government financial and technical assistance is also used to supply the additional incentive needed by industry to take the risks involved in implementing new or modified production methods.<sup>195</sup> Examples of Dutch industries that have successfully implemented new production techniques or management methods to reduce waste production include an industry that produces chlorine using an electrolytic process and membrane technology to avoid generation of mercury and asbestos wastes;<sup>196</sup> and an industry producing creosote and polymers that has reduced waste production through better management of feedstocks, raw materials, and residues.<sup>197</sup>

*d. United Kingdom*

As stated in the earlier description of the state of hazardous waste management and regulation in the United Kingdom, the primary method of managing hazardous waste in that country is land disposal. A recent evaluation of U.K. practices in hazardous waste management, while highly critical of many aspects of current regulations and practices, makes no mention of the desirability of encouraging industry to reduce its production of hazardous waste.<sup>198</sup> Information describing the financial support available from the U.K. Department of Trade and Industry to support industrial innovation and investment in new technologies and product lines makes no mention of pollution prevention as a desirable goal of technology development or as a criteria in selecting grant recipients.<sup>199</sup> The Department of the Environment has commissioned a report on the possibilities for source reduction of heavy metal-bearing wastes from the metal plating industry.<sup>200</sup> The report concludes that the high level of capital costs involved in establishing a central treatment facility and in-

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<sup>195</sup> *Id.*

<sup>196</sup> See NETHERLANDS PROGRAMME, *supra* note 118, at 41.

<sup>197</sup> Hazewinkel Interview, *supra* note 112.

<sup>198</sup> See Hazardous Waste Management—An Overview, *supra* note 50.

<sup>199</sup> See DEPT. OF TRADE AND INDUSTRY, INNOVATION SUPPORT FOR BUSINESS (1985); DEPT. OF TRADE AND INDUSTRY, INVESTMENT SUPPORT FOR BUSINESS (1985).

<sup>200</sup> See ECOTEC Research and Consulting Ltd., Reducing Metals in the Environment: A Report for the Department of the Environment.

plant ion exchange equipment suggests that some form of subsidy would be needed to encourage firms to implement this approach.<sup>201</sup> The Report also pointed out that plating firms were generally poorly informed of the technical and financial effectiveness of alternative treatment technologies.<sup>202</sup>

Limited technical assistance to hazardous waste generators appears to be available in the U.K. from Harwell Laboratories and from a private organization called the Clean Technologies Information Centre. At least one local waste disposal authority provides technical advice to hazardous waste generators in its jurisdiction concerning technical and management methods to reduce hazardous waste production.

Harwell Laboratories is a major government sponsored research institution. Through its Environmental Safety Group, Harwell offers a variety of services relating to solid and hazardous waste management to public and private organizations.<sup>203</sup> Advice on waste management and dissemination of information through a regularly published bulletin are among the services offered by Harwell. Waste minimization is not expressly mentioned as one of the areas for which assistance is available.

The Clean Technologies Research Centre, located in Birmingham, is operated by a private consulting firm called ECOTEC.<sup>204</sup> The Centre is supported by the Commission of the European Communities in Brussels. Its goals are to diffuse knowledge and exchange information about pollution preventing technologies and to stimulate industry to implement those technologies. To carry out these goals, the Centre offers advice, market information and other related assistance to both industry and regulatory agencies. ECOTEC also plays an active role in the ongoing development of hazardous waste minimization strategies in Europe through its other work for the Commission of the European Community, including development of a proposal for a community-wide environmental technology transfer program,<sup>205</sup> and a detailed evaluation of European examples of pollution preventing technologies.<sup>206</sup>

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<sup>201</sup> *Id.* at 0/11.

<sup>202</sup> *Id.*

<sup>203</sup> See HARWELL LABORATORIES, WASTE MANAGEMENT PROBLEMS? (n.d.). The Environmental Safety Group receives support from the Department of the Environment.

<sup>204</sup> Interview with Frank Joyce, Richard Haines, and Jonathan Fisher, staff of ECOTEC, in Birmingham (May 14, 1986) [hereinafter ECOTEC Interview]. This interview provided general information on the activities of ECOTEC.

<sup>205</sup> For a description of this EC proposal, see *infra* notes 184-228 and accompanying text.

<sup>206</sup> ECOTEC RESEARCH AND CONSULTING, LTD., POTENTIAL ECONOMIC BENEFITS FROM INTEGRATING ENVIRONMENTAL AND POLLUTION CONTROL MEASURES INTO INDUSTRIAL

Finally, one local waste disposal authority, the West Midlands County Council Waste Disposal Department,<sup>207</sup> has expressly adopted hazardous waste reduction as a policy goal and has taken steps to encourage industries in its jurisdiction to reduce hazardous waste production.<sup>208</sup> The County Council viewed waste reduction as at least a partial answer to continued provision of adequate waste disposal capacity and as a means to assist industry to reduce disposal costs. The waste reduction policy is carried out by personnel of the Waste Disposal Department through plant inspections under the Department's enforcement authority, and through surveys of current waste production and management practices. The authority also provides information to industries on methods of waste recovery and re-use and sponsors a waste exchange.

*e. The European Community (EC)*

The European Community (EC) seeks to encourage hazardous waste minimization in two ways: first, through limited financial assistance for demonstration projects; and second, through research concerning the establishment of a community-wide environmental technology transfer network. Both of these efforts are being carried out by the Commission of the European Community, the executive arm of the EC in Brussels. In addition, it has been suggested that the European Regional Development Fund, a program of the EC that encourages indigenous industrial development to reduce regional economic disparities, should provide financial assistance for new environmentally sound technologies.<sup>209</sup>

The interest of the European Community in the notion of clean technologies can be traced to an invitation to the Commission in 1979 by the Council of Environmental Ministers to evaluate the clean technology programs of Member States, to promote technical information exchange, and to make recommendations and proposals for

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PROCESSES: A SERIES OF CONCRETE EXAMPLES (1985) (Final Report prepared for Directorate General for Environment, Consumer Protection and Nuclear Safety, Commission of the European Communities) [hereinafter REPORT ON CONCRETE EXAMPLES OF CLEAN TECHNOLOGIES].

<sup>207</sup> Since the abolition of the County Councils, this Department has been functioning under the auspices of the Walsall Borough Council under an agreement between the seven boroughs formerly included in the County Council.

<sup>208</sup> Interview with David O'Connor, Mark Springer, and Peter Harvison, staff of the West Midlands Waste Disposal Authority, at Birmingham (May 12 and 14, 1986). See also West Midlands County Council Waste Disposal Department, Pollution Control in the West Midlands (n.d.).

<sup>209</sup> ECOTEC Interview, *supra* note 204.

EC support of clean technologies.<sup>210</sup> In 1984, the Council adopted a regulation establishing a three year program of financial assistance to encourage implementation of clean technologies.<sup>211</sup> This regulation provided 6.5 million ECU<sup>212</sup> for clean technology demonstration projects, to be used for grants for up to 30 percent of the capital cost of any project.<sup>213</sup> To be eligible for a grant, a project must implement a technology that has already been proven at the research phase, encourage the use of similar methods in other locations, and affect a facility or process that produces a large amount or a particularly dangerous quality of emissions into the environment.<sup>214</sup> The regulation lists specific types of emissions, effluents or waste streams for which projects are eligible.<sup>215</sup>

To date, there has been one round of applications and grants under this EC program. There were 50 applications for the grants, of which ten were selected for grants totalling 3 million ECU.<sup>216</sup> Of the ten projects funded by the Commission, six were process modifications or substitutions while four were resource recovery projects. The Commission cited industry's lack of information about the grants and fear of sharing technical knowledge with competitors and government regulators as reasons for the low number of applications.<sup>217</sup> All information on the projects will be kept confidential by the Commission until final reports are published. The first reports are due in 1987. A separate report prepared for the Commission documents nine case studies of industrial implementation of clean technologies.<sup>218</sup> The Commission is now preparing for a second call for applications for the grant program. In the future, the Commission may seek to modify the program to promote the development of environmentally sound products as well as non-polluting industrial processes.<sup>219</sup>

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<sup>210</sup> Council Resolution on the continuation and implementation of a European Community policy and action programme on the environment (1982 to 1986), annex IV.30, *reprinted in* 26 O.J. EUR. COMM. (No. C46), at 14-15 (1983) (adopting the Third Action Programme on the Environment).

<sup>211</sup> See Council Regulation No. 1872/84, 27 O.J. EUR. COMM. (No. L176) (1984) [hereinafter Council Regulation No. 1872/84].

<sup>212</sup> ECU is the acronym for European Currency Unit.

<sup>213</sup> Council Regulation No. 1872/84, *supra* note 211, art. 1.

<sup>214</sup> *Id.* art. 2.

<sup>215</sup> *Id.* annex I.

<sup>216</sup> Junger, *supra* note 137, provided information about the administration of the EC grant program.

<sup>217</sup> *Id.*

<sup>218</sup> See REPORT ON CONCRETE EXAMPLES OF CLEAN TECHNOLOGIES, *supra* note 206.

<sup>219</sup> Junger, *supra* note 137.

In the area of technical assistance, the Commission has sponsored research for the purpose of developing a community-wide network that would provide information, advice, and promotion concerning clean technologies. This research is being carried out by the British consulting firm ECOTEC<sup>220</sup>, which has prepared a summary report on a study of the feasibility of such a network.<sup>221</sup> The ECOTEC Report lists a number of key barriers to the use of new environmentally sound technologies, especially by small and medium sized firms.<sup>222</sup> Several of these key barriers are related to lack of current and objective information, advice and expertise concerning new technologies that are available to reduce or prevent pollution. The Report also points out the importance of developing uniform environmental standards among Member States in the EC in order to develop a larger and stronger market for pollution control equipment and pollution prevention technologies.<sup>223</sup>

With regard to the availability and exchange of information on clean technologies, the Report found that there were few organizations in Europe that specialized in providing information and advice on clean technologies, citing the French and Dutch programs as the best examples.<sup>224</sup> The Report found that no organization actively seeks out and targets firms or industry sectors for assistance with clean technologies or advice on improved environmental management methods.<sup>225</sup> Such an organization should be able to present alternative technology choices to targeted firms and assist in developing customized solutions to fit individual production processes.<sup>226</sup>

The ECOTEC Report recommends the establishment of a network of regional centers to link existing locations of European expertise in clean technologies. According to ECOTEC, the network should actively promote new technologies, provide links between the clean technology market and the manufacturers, suppliers, and installers of new equipment, and act as a general source of information and advice to industry and government agencies.<sup>227</sup> While funds from the EC might be used to establish the network and get its work under-

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<sup>220</sup> See *supra* note 204 and accompanying text.

<sup>221</sup> See ECOTEC RESEARCH CONSULTING LTD., NETWORK FOR ENVIRONMENTAL TECHNOLOGY TRANSFER (1986).

<sup>222</sup> *Id.* at 2.

<sup>223</sup> *Id.* at 3.

<sup>224</sup> *Id.* at 5.

<sup>225</sup> *Id.*

<sup>226</sup> *Id.* at 7.

<sup>227</sup> *Id.* at 10-11.

way, the long term goal would be to make the network an independent, self-supporting institution. Under the ECOTEC proposal, the network would sell subscriptions to approximately 100 members in each region of operation, including industry trade associations, government agencies, universities, and pollution control equipment consultants and manufacturers. Members would participate in the organization and administration of the network. Additional income could be provided by fees for services, contributions by interested governments or private organizations, and even "royalties" from successfully facilitated projects.<sup>228</sup> At this writing, ECOTEC is exploring whether there is sufficient interest among potential subscribing members in the EC to warrant further work on development of such an environmental technology network.

*C. Promoting Hazardous Waste Minimization Through Increased Cost of Waste Production, Treatment, and Disposal*

This section of the Study examines the manner in which the actions of European governments have promoted hazardous waste minimization through negative economic incentives that have increased the costs of producing, treating and disposing of hazardous waste. Governmental authorities can influence waste management costs by controlling the siting, permitting and operational standards of treatment and disposal facilities; by imposing liability standards (and associated insurance requirements) on waste generators, transporters and facility owners; and by levying taxes and fees on waste production and management. Actions by government in these areas can significantly increase the cost and limit the availability of treatment and disposal options, thus providing strong incentives for industry to minimize the production of hazardous waste.

1. Cost and Availability of Waste Management Alternatives:  
Influence of Government Regulatory Actions

Among the public and private officials interviewed, none disagreed with the proposition that economics is the driving force for industry in deciding how to manage hazardous waste. The cost of waste treatment and disposal as compared to the cost of waste minimization is one of the most important factors in this economic equation.<sup>229</sup>

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<sup>228</sup> *Id.* at 11-14.

<sup>229</sup> The cost of waste treatment and disposal, including the cost of regulatory compliance, was cited as an important economic factor in reducing waste production and selecting waste

Without systematically examining actual per ton costs of various treatment and disposal options in different countries, it is possible to get a general idea of whether European waste management costs are sufficiently high to encourage industries to minimize their hazardous waste production. It is also possible to evaluate the attitude of government authorities toward the additional waste management costs that may be imposed as a result of government action.

*a. Germany and the Netherlands*

In Germany and the Netherlands, the increase in treatment and disposal costs that results from government intervention in hazardous waste management is viewed as complementary to governmental efforts to encourage clean technologies and to tighten direct regulation on the production of hazardous wastes.<sup>230</sup> In Germany, government actions that increase treatment and disposal costs are not merely acknowledged, but are considered part of a deliberate government policy to promote hazardous waste minimization.<sup>231</sup> Yet some officials expressed the opinion that treatment, disposal and regulatory costs are not high enough anywhere in the European Community to be a significant incentive to reduce hazardous waste production.<sup>232</sup>

Government intervention in waste management which increases the cost of treatment and disposal takes various forms in Germany and the Netherlands. In Germany, such intervention includes development of technical standards for the kind of treatment and disposal required for the various types of hazardous waste;<sup>233</sup> state participation in the establishment of advanced waste treatment and

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management alternatives by a number of people. Eberlein Interview, *supra* note 58; Nels Interview, *supra* note 94; Jung & Platz Interview, *supra* note 110; H. Michael Kromarek, Director of Environmental Enforcement for Cologne Region, State of North Rhine-Westphalia in Cologne, West Germany (May 6, 1986) [hereinafter Kromarek Interview]; Interview with H. G. Friesecke, Director, State Institute for Water and Waste, State of North Rhine-Westphalia in Dusseldorf (Apr. 30, 1986) [hereinafter Friesecke Interview]. Stolz Interview, *supra* note 43; Hazewinkel Interview, *supra* note 112; interview with M. Jacques Salamitou, Director of Environmental Protection, Rhône-Poulenc in Paris (Apr. 16, 1986) [hereinafter Salamitou Interview].

<sup>230</sup> Kromarek Interview, *supra* note 229; Nels Interview, *supra* note 94; Henselmans Interview, *supra* note 47.

<sup>231</sup> Stolz Interview, *supra* note 43; Friesecke Interview, *supra* note 229.

<sup>232</sup> ECOTEC Interview, *supra* note 204; Junger Interview, *supra* note 137. An official of the Dutch Ministry of the Environment expressed the opinion that the costs of alternative methods of waste management are high enough in the Netherlands to encourage waste minimization. Hazewinkel Interview, *supra* note 112.

<sup>233</sup> See *supra* notes 110-111 and accompanying text.



disposal facilities where industry is required to manage its hazardous waste;<sup>234</sup> and insistence on high technical requirements for the construction and operation of new treatment and disposal facilities.<sup>235</sup> In the Netherlands, a general ban on land disposal of hazardous waste<sup>236</sup> forces waste producers to seek alternatives, such as incineration and treatment, that are often more expensive than land disposal. The land disposal ban is complemented by the government's efforts to assist the development of a new, integrated hazardous waste treatment facility and to encourage research and development of waste minimizing technologies.<sup>237</sup> In Germany and the Netherlands, the siting of new waste management facilities is difficult because of geological conditions, high population density, and public and political opposition. This means that land disposal capacity in those countries will continue to be very limited. This scarcity of land disposal capacity will contribute to increases in the cost of disposal and will encourage waste minimization.<sup>238</sup>

*b. France*

In France, while government actively promotes waste minimization through financial assistance for the implementation of clean technologies, government policy concerning the cost and availability of treatment and disposal alternatives may actually drive waste producers in the opposite direction. It is commonly agreed among French officials that the cost of environmentally sound methods of

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<sup>234</sup> Two German States, Bavaria and Hesse, have participated in the construction and operation of hazardous waste treatment and disposal facilities. The Bavarian facilities include incineration, a variety of other treatment processes, and disposal. Jung & Platz Interview, *supra* note 110. Hesse has completed an incineration facility and two chemical-physical treatment facilities. Zubiller Interview, *supra* note 101. Two other States, Rhineland-Palatinate and Baden-Württemberg, are cooperating to develop an incinerator. Jung & Platz Interview, *supra* note 110.

<sup>235</sup> In the State of Hesse, for example, completion of a new government-sponsored land disposal facility has been interrupted by legal action. In order to complete this facility it is likely that a number of additional design and operational changes will have to be made including: segregation and solidification of waste placed in the facility; limitation of any leachate from the facility to drinking water standards; and construction of a roof over operating areas of the facility. Zubiller Interview, *supra* note 101.

<sup>236</sup> See *supra* notes 118-124 and accompanying text.

<sup>237</sup> A Dutch environmentalist expressed the opinion that the landfill ban should be applied more strictly in order to promote other management alternatives including minimization. Henselmans Interview, *supra* note 47.

<sup>238</sup> Hartenstein Interview, *supra* note 127; Komorowski Interview, *supra* note 134; Stolz Interview, *supra* note 43; and Interview with H. Noordmans and H. Jacobs, Shell-Rotterdam, in Rotterdam (May 21, 1986) [hereinafter Noordmans & Jacobs Interview].

hazardous waste treatment and disposal should be kept relatively low in order to discourage waste producers from using unsafe and illegal methods.<sup>239</sup> This policy is reflected in a number of governmental actions, including the offering of subsidies by the River Basin Finance Agencies for transportation and treatment of hazardous wastes,<sup>240</sup> participation of ANRED in the ownership and operation of the largest hazardous waste disposal company in France,<sup>241</sup> and reluctance to implement existing regulatory authorities that could require waste producers to use more expensive and sophisticated treatment facilities.<sup>242</sup> Nevertheless, hazardous waste minimization is an explicit governmental policy in France.

*c. United Kingdom*

In the United Kingdom, there appears to be little or no pressure on industry to minimize hazardous waste production because of the low cost of other waste management alternatives. Government regulations and policy in the U.K. have resulted in a large available capacity for inexpensive land disposal of hazardous waste.<sup>243</sup> Lack of adequate and uniform enforcement of license regulations at these facilities means that reputable operators must compete with those who cut their costs by ignoring the regulations.<sup>244</sup> The low cost of land disposal has also made it difficult for other "high technology" treatment facilities such as incinerators to remain in business.<sup>245</sup> Thus, there is very little incentive for industry in the U.K. to consider waste minimization as a way to reduce operating costs. A publication of the U.K. chemical industry describing the industry's views on hazardous waste management makes no mention of waste

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<sup>239</sup> Lemarchand Interview, *supra* note 34; Combrouze Interview, *supra* note 26.

<sup>240</sup> According to one official of the Ministry of the Environment these subsidies discourage waste producers from considering waste reduction or prevention. Olier Interview, *supra* note 26.

<sup>241</sup> ANRED is authorized to participate in the equity ownership and control of private waste management firms. Under this authority, ANRED has agreed to participate as a holder of ten percent of the shares of France-Déchets, the direct or indirect owner of nine out of the thirteen hazardous waste land disposal facilities in France. The other major participants in the ownership of France-Déchets are the two large public water companies of France and ELF, a French petrochemical company. Buquet Interview, *supra* note 33.

<sup>242</sup> See, e.g., *supra* note 136 and accompanying text.

<sup>243</sup> In 1984 approximately 88 percent of all hazardous waste produced in the U.K. was disposed of in land disposal facilities. Hazardous Waste Management—An Overview, *supra* note 50, at 15.

<sup>244</sup> *Id.* at 19.

<sup>245</sup> *Id.* at 35.

minimization as part of an overall management strategy.<sup>246</sup> A manager of one of the branches of the U.K.'s largest chemical company stated that the efforts by that company's paint manufacturing operation to develop and implement a new production process to avoid the use of organic chemical solvents were made largely in response to the regulatory climate in other European countries where the company has manufacturing plants.<sup>247</sup>

*d. Non-uniformity of national waste management standards: the export escape*

Although waste producers are subject to more stringent regulations and higher costs to treat and dispose of hazardous waste in countries such as Germany and the Netherlands, waste reduction is not the only alternative available to avoid the higher costs. Lack of uniformity of hazardous waste regulations in the Member States of the European Community and the ability to freely export hazardous waste across national borders has allowed waste producers to escape higher regulatory and management costs by shipping their wastes to cheaper facilities in other countries.<sup>248</sup> Even in Germany, where the government has attempted to strictly regulate the export of hazardous waste, a substantial quantity of waste is exported for both ocean and land disposal.<sup>249</sup> The largest single land disposal destination for exported waste in Europe is a landfill in the German Dem-

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<sup>246</sup> See CHEMICAL INDUSTRIES ASSOCIATION, *WE CARE ABOUT WASTE* (1983). In contrast, see European Council of Chemical Manufacturers' Federation (CEFIC), *Industrial Waste Management* (1985), setting forth the approach of the CEFIC, which begins with sections on waste reduction and waste recovery.

<sup>247</sup> Telephone Interview with Dave Chadderton, Environmental and Safety Advisor, ICI, Slough, U.K. (May 15, 1986) [hereinafter Chadderton Interview]; see *supra* notes 318-19 and accompanying text.

<sup>248</sup> Non-uniformity of treatment and disposal standards is a major cause of transfrontier movement of hazardous waste in Europe. Yakowitz Interview, *supra* note 74. Higher waste management costs in Germany and lack of availability of treatment and disposal facilities in the Netherlands have led to substantial exports of hazardous waste from those countries. *Id.*; Nels Interview, *supra* note 94; Henselmans Interview, *supra* note 47.

<sup>249</sup> Under the Third Amendment to the Waste Disposal Act, Act of January 31, 1985, BGBI.I 204, an export license may be granted by the State only if the waste producer shows that no facility is available in Germany to treat or dispose of the waste and that the facility to which the waste is exported operates under equivalent standards to those required in Germany. Preusker & Skalicky Interview, *supra* note 186; Nels Interview, *supra* note 94. Despite these requirements, 26.8 percent or about 1.3 million tons of Germany's hazardous waste was exported to other countries in 1983. Of that amount, about 900,000 tons went to Belgium primarily for ocean incineration and about 350,000 tons went to the German Democratic Republic for land disposal. Nels Interview, *supra* note 94.

ocratic Republic (East Germany) located a few miles from the border with the Federal Republic near the town of Schönberg.<sup>250</sup>

## 2. Costs Associated with Legal Liability of Waste Producers

The production of hazardous waste and the treatment and disposal activities required to manage the waste can result in harm to the environment and injury to persons and property. The legal liability of waste producers for such harm or injuries is another potential source of costs which could be avoided if the waste were not produced in the first place. The purpose of examining the liability issue here is to determine in a general way the influence of European liability laws on the behavior of waste producers; that is, to determine whether the potential cost of liability claims resulting from treatment and disposal activities is an important factor in discouraging production of hazardous waste. It is not intended to provide a detailed analysis here of the laws which form the basis for liability.

Based on interviews with persons knowledgeable on the subject, liability for claims arising from treatment and disposal activities is not a significant factor for European waste producers in assessing their overall cost of producing and managing hazardous wastes. In general, therefore, liability costs are not an important incentive to European waste producers to reduce or prevent production of waste. There are several reasons why liability is not a significant cost factor.

First, certain characteristics of European liability law make recovery of damages difficult and limit the amount of damages which may be recovered for any injury, especially injury caused by hazardous waste. Second, absent some negligent or illegal act, European waste producers are generally not subject to liability for injury caused by waste after it has passed into the possession of another person. Third, the discovery of a large number of contaminated hazardous waste sites in Europe has not led to the kinds of changes in liability law that have occurred in the United States. And fourth, waste producers have not been subjected to substantial costs related to financial assurance for the proper operation of treatment and disposal facilities used to manage their wastes.

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<sup>250</sup> Yakowitz Interview, *supra* note 74; Nels Interview, *supra* note 94. According to an official of the German Chemical Manufacturers Association, the Schönberg facility has been inspected by experts from the Federal Republic of Germany and found acceptable under the German export control requirements. Preusker and Skalicky Interview, *supra* note 186.

*a. European tort liability in general*

Before discussing the legal standards for determining the liability of European waste producers for injuries to the environment or to persons, it may be useful to give a brief sketch of some of the general characteristics of European tort law.<sup>251</sup> These characteristics tend to illustrate the limited role that tort liability is likely to play in influencing waste producers to minimize hazardous waste production. Perhaps the most significant characteristic of European tort law in this respect is the relatively narrow scope of damages which may be recovered by a party who has suffered a personal injury. Assuming that the injured party has proven his case under whatever legal standard may apply, the types of damages which that party can recover for his injuries are generally limited to economic losses actually incurred such as hospital and doctors costs. Non-tangible or non-economic losses, generally categorized as "pain and suffering" under American law, are limited to loss of a physical function or capability. The amount recovered for such losses is generally small.<sup>252</sup> Income lost by reason of the injury is paid to the injured party under social security systems operated by the government; loss of income, therefore, is not recoverable in a lawsuit except by the social security program. Losses to be incurred in the future will be awarded only if the losses can be predicted with a high degree of certainty. Punitive damages, designed to impose a penalty on a defendant for particularly offensive conduct regardless of the value of the actual loss or injury, are not imposed by European courts. Finally, the loser in the lawsuit must pay the attorney fees of the winning party. This deters injured parties from bringing lawsuits where the outcome is doubtful.

The contrast between the scope of recovery under European and United States tort law is striking. In the United States, proven loss of income, both past and future, would be recoverable based upon the injured party's actual or reasonably anticipated earnings.<sup>253</sup> Loss of a physical function as well as other non-tangible pain and suffering can result in large damage awards, sometimes in the millions of

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<sup>251</sup> This discussion of tort liability in Europe is based on an interview with Mr. Ludwig Krämer, Attorney, Commission of the European Community. See Krämer Interview, *supra* note 70.

<sup>252</sup> Krämer Interview, *supra* note 70. A recovery of the equivalent of \$40,000 for total paralysis suffered by a twenty year old person was cited by Krämer as the largest award for pain and suffering that he was aware of in Europe.

<sup>253</sup> See, e.g., Dunnell Minnesota Digest, Damages § 3.01 (m).

dollars.<sup>254</sup> Punitive damages are also available in certain circumstances.<sup>255</sup> Finally, in the United States, an injured party's attorney is entitled to a percentage share of his client's recovery if the lawsuit is successful, not merely the actual costs of representation. If the injured party loses, that party's attorney must bear his own costs, and the losing party is not generally required to pay the winning party's costs, as would be the case in Europe.

A second characteristic of European tort law which limits the likelihood of recovery by an injured party is the difficulty of proving, especially in the context of an injury caused by pollution of the environment, that the acts or omissions of the defendant were the actual and legal cause of the injury. In this respect, European law probably does not differ significantly from American law. The comments of one French environmental law expert would probably elicit the agreement of American lawyers familiar with environmental torts:

Whatever may be the basis of liability found by the judge, it is very difficult to provide proof of a link between the injury and the environmental damage in cases of environmental tort. Quite often the pollution is diffuse, slow to manifest itself, or deceptive, and requires long and costly scientific study. Even if it is agreed that such pollution affects the water, air or fauna, it is more difficult to establish the extent to which a third party may be harmed by a "ricochet." The causal link to the pollution is inevitably an indirect one, and leads to a virtual denial of justice.<sup>256</sup>

The difficulty of proving that hazardous wastes are the legal cause of an injury, particularly where a great length of time has elapsed between the polluting event and discovery of the injury, diminishes the likelihood of a successful lawsuit to recover damages for the injury.

One other characteristic of European tort law may have a bearing on an injured party's ability to recover for injuries caused by haz-

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<sup>254</sup> See, e.g., *Philadelphia Jury Awards \$2 million; Punitive Award Assessed Against Merrell Dow*, *Toxics Law Reporter* (BNA) No.33, at 916 (Jan. 28, 1987).

<sup>255</sup> There is now a movement in the United States to limit the sizes of awards for pain and suffering, other intangible losses, and punitive damages. See, e.g., Minn. Laws 1986, ch. 455, §§ 82, 88, Act of March 25, 1986, ch. 455, §§ 82, 88, 3 Minn. Leg. Serv. 365, 436, 441 (West 1986) (codified as Minn. Stat. §§ 549.191, 549.23). See also, *Rep. Delbert Latta Reintroduces White House Task Force Reform Bill*, *Toxics Law Reporter* (BNA) 1003 (Feb. 11, 1987); *ABA Litigation, Tort Sections Propose Controls on Punitive Awards* 1 *Toxics Law Reporter* (BNA) 1004 (Feb. 11, 1987); *Nader Calls Tort Reform Movement "Backlash" to Historic Common Law Rights* 1 *Toxics Law Reporter* (BNA) 964 (Feb. 4, 1987).

<sup>256</sup> Prieur, *supra* note 90, at 1045; (translation by the Author).

ardous waste. Under European law it is generally difficult to obtain documents and other evidence from the defendants before trial of a lawsuit. The injured party must have a substantial basis for requesting such evidence and must be able to identify with some specificity the documents he is seeking.<sup>257</sup> In cases where the source or cause of the polluting event is not obvious to the injured party, it may be impossible to know with any degree of certainty what evidence to seek from the polluter. Only the polluter, if anyone, knows what occurred and why it occurred; and he is not required to respond to general requests from the injured party to share the evidence that may exist on these questions. This restrictive policy is in sharp contrast to the quite liberal discovery rules that would be applied in a similar lawsuit in the United States.<sup>258</sup>

*b. Waste producer liability in Europe*

In Europe, the producer of hazardous waste is generally liable for only those injuries caused while the waste is under the producer's control.<sup>259</sup> This liability may be extended if the producer disposes of the waste in a negligent or illegal manner, or is negligent in selecting a transporter or disposal facility.<sup>260</sup> There is no clear movement in Europe toward a legal doctrine like that of the federal Superfund Law in the United States, which holds producers liable without fault for waste deposited in a disposal facility owned and operated by another party.<sup>261</sup>

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<sup>257</sup> Krämer Interview, *supra* note 70.

<sup>258</sup> See MCFARLAND & KEPPEL, MINNESOTA CIVIL PRACTICE § 1501; WRIGHT & MILLER, FEDERAL PRACTICE AND PROCEDURE §§ 2001, 2007 (1982).

<sup>259</sup> J.P. Hannequart, Questions de Responsabilité Relatives aux Décharges, 2 (unpublished paper) (Oct. 30, 1985) [hereinafter Liability Issues].

<sup>260</sup> *Id.*; Interview with H. Szelenski, Attorney, UBA, in Berlin (Apr. 21, 1986) [hereinafter Szelenski Interview].

<sup>261</sup> CERCLA, 42 U.S.C. § 9607(a) (1982). Thirty-nine states also have some form of Superfund law. Note, *The Impact of State "Superlien" Statutes on Real Estate Transactions*, 5 VA. J. NAT. RESOURCES L. 297, 297 n.1 (1986). Several officials interviewed expressed the view that strict liability of the type imposed by CERCLA was not likely to be adopted in Europe. Krämer Interview, *supra* note 70; Wicke Interview, *supra* note 105. In the United States, the enactment of statutes imposing liability for pollution and injuries caused by hazardous waste resulted from the need to remedy the damage caused by old or abandoned hazardous waste disposal sites. Strict, joint and several liability was imposed by Congress on producers, transporters, and disposal site owners and operators so that the government could recover its site cleanup expenses from those who profited from the polluting activity. The liability was made retroactive in order to allow recovery for currently contaminated sites created by the past actions of these parties. In Europe, while the problem of old hazardous waste sites is at least as serious as in the United States, the impact so far in terms of liability law reform, and even in terms of public money committed to cleanup, has been modest. See *infra* note 295.

i. Belgium and the Netherlands

Only two countries, Belgium and the Netherlands, seem to take an approach to waste producer liability that differs from the general European approach. Belgium has enacted a statute that clearly imposes strict liability on waste producers, including liability for damages suffered after the producer has delivered the waste to a third party for disposal.<sup>262</sup> With respect to this law, one commentator has stated, "The reason for it [the Belgian law] is without doubt that the producer is well situated to recognize all of the risks associated with the wastes (not to mention the rationale for a legal mechanism to encourage reduction of waste at the source)."<sup>263</sup> The Netherlands has enacted a law providing a substantial amount of money to clean up old contaminated sites and allowing the government to recover its cleanup costs from producers who disposed of waste illegally.<sup>264</sup>

ii. France

In France, the current state of the law on producer liability for waste that has been delivered to another party for disposal is at best ambiguous. Several provisions of the 1975 French Framework Law<sup>265</sup> refer to the obligations or liability of waste producers. Article 2 of the law states that:

every person who produces or possesses wastes in conditions that are such as to produce harmful effects to soil, flora or fauna, to degrade particular sites or the countryside, to pollute air or water, to cause noise or odors, and in a general way threaten human health and the environment, has the duty to assure or provide assurance of the disposition of the wastes in compliance with this law, in conditions appropriate to avoid the above-mentioned harms.<sup>266</sup>

Article 4 states that compliance with the requirements of the Framework Law does not limit the liability that may be incurred by any person, including one who possess or transports waste, by reason of injuries caused to others.<sup>267</sup> However, the most problematic provi-

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<sup>262</sup> Law of July 22, 1974 on Toxic Waste, art. 7 *Moniteur Belge*, Mar. 1, 1975; *see also* Liability Issues, *supra* note 259, at 5.

<sup>263</sup> Liability Issues, *supra* note 259, at 5.

<sup>264</sup> Soil Rehabilitation Law of December 29, 1982. *See* Liability Issues, *supra* note 259, at 9.

<sup>265</sup> Law 75-633 of July 15, 1975, J.O. 4820-23 (Framework Law).

<sup>266</sup> *Id.* art. 2, para. 1 (translation by the Author).

<sup>267</sup> *Id.* art. 4, para. 2.



sion of the Framework Law concerning liability is that of Article 11. This Article is intended to work in tandem with Article 9, under which the government can designate facilities approved for the treatment or disposal of specified types of hazardous wastes. Article 11 states simply that anyone who delivers or causes to be delivered any hazardous waste of a type specified pursuant to Article 9 to *any person other than the operator of a facility approved under Article 9* is jointly liable with that person for injuries caused by the waste.<sup>268</sup> The law is silent on whether liability is imposed with or without a showing of fault.

The difficulty in interpreting Article 11 arises because the government has not specified hazardous waste streams or approved any facilities under Article 9. One possible implication of this situation is that generators may be jointly liable for all waste currently being delivered to facilities operated by others. In order to avoid this implication, some French waste producers argue that facility approval for purposes of liability under Article 11 should be interpreted to mean facility authorization under the Law on Registered Installations.<sup>269</sup> Others have urged the government to take action to implement Article 9 and to clarify the relationship between the Framework Law and the Law on Registered Installations.<sup>270</sup> It has also been pointed out that, even if Article 9 were implemented and waste were delivered to a facility approved under that Article, this would *not* completely insulate a producer from liability for injuries subsequently caused by the waste.<sup>271</sup> Negligent or illegal acts by the producer related to the delivery of the waste to the facility could still result in liability. Nevertheless, it appears that implementation of Article 9 would have a powerful influence on waste producers, who would probably take pains to use approved facilities in order to avoid the clear risk of liability for doing otherwise.

In addition to the provisions of the Framework Law, French law includes at least two theories by which the owner or operator of a disposal facility (including a waste producer with an on-site or proprietary facility) may be found liable without fault for pollution caused by the facility. One theory provides that a person is liable without fault for injuries caused by things under that person's con-

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<sup>268</sup> *Id.* art. 11. (emphasis added).

<sup>269</sup> Combrouze Interview, *supra* note 26; see Law on Registered Installations, *supra* note 17.

<sup>270</sup> RAPPORT SERVANT, *supra* note 32, at 23-24.

<sup>271</sup> *Id.*

trol.<sup>272</sup> This theory has apparently been applied to impose liability on a chemical company with regard to gases escaping from its factories.<sup>273</sup> The second theory provides that the owner or operator of a facility may be held strictly liable for interfering with the use or enjoyment of property in the neighborhood surrounding the facility.<sup>274</sup> The injury or interference must exceed that which the neighboring area would normally be expected to bear. The determination that an injury is beyond the norm depends upon whether the activities carried out at the facility are compatible with those of the adjacent area. The concept closely resembles the Anglo-American common law doctrine of nuisance.

### iii. Germany

The status of the law on waste producer liability in Germany is somewhat similar to that in France. In general, fault is required as a condition of a producer's liability for injuries caused by waste under his control.<sup>275</sup> However, a person may be held strictly liable for causing the pollution of underground or surface water.<sup>276</sup> The owner of a disposal facility may also be held strictly liable for damage to neighboring property under a nuisance law concept.<sup>277</sup> In the case of a waste producer who has delivered the waste to a disposal facility operated by another party, the producer may be liable for pollution at that facility if he failed to properly choose the person who disposed of the waste.<sup>278</sup> There is currently discussion among interested parties in Germany concerning whether producers or facility operators may be held liable for injuries when they were acting in full compliance with government regulations.<sup>279</sup> There has also been some suggestion by German legal experts that strict liability under a products liability theory might be applied to producers of hazardous waste.<sup>280</sup> But, in general, unless a waste producer is shown to have acted illegally or if the source of the pollution is a disposal site owned by

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<sup>272</sup> PRIEUR, *supra* note 90, at 1041. This liability is founded on C. CIV. art. 1384, § 1, a provision of the French Civil Code.

<sup>273</sup> PRIEUR, *supra* note 90, at 1041 (citing Civ., 17 déc. 1969, *Bull.*, p.261).

<sup>274</sup> PRIEUR, *supra* note 90, at 1042-43.

<sup>275</sup> Szelenski Interview, *supra* note 260.

<sup>276</sup> *Id.* According to Szelenski, this liability is imposed under the Water Management Act of 1964. *Id.*

<sup>277</sup> Interview with H. Jürgen Staube, Attorney, UBA, Berlin (Apr. 22, 1986) [hereinafter Staube Interview].

<sup>278</sup> Szelenski Interview, *supra* note 260.

<sup>279</sup> Kromarek Interview, *supra* note 229; Preusker & Skalicky Interview, *supra* note 186.

<sup>280</sup> Staube Interview, *supra* note 277.

the producer, there seems to be no serious threat that the producer will be held liable for injuries caused by the waste.<sup>281</sup>

iv. European Community proposal

The Commission of the European Community is preparing a proposal for the Council concerning the liability of producers of hazardous waste for pollution and injuries caused by the waste. While no official draft was available at the time of the Author's visit to the Commission, the official drafting the proposal discussed several likely elements of the proposal.<sup>282</sup> The proposal probably will apply strict liability (liability without fault) for injuries caused by hazardous waste. While the proposal will apply to producers and transporters of the waste, their liability will probably terminate when the waste is delivered to the operator of a treatment or disposal facility. The release of the producer or transporter from further liability will probably be conditioned upon compliance with all legal requirements, such as deposit with a legally permitted facility and deposit of a type of waste which the facility is allowed to handle. In addition, the release from liability may be conditioned on the use of specific treatment or disposal techniques approved for the type of waste in question. This last condition could be the means to encourage uniformity of technical standards for waste treatment and disposal in the European Community. The liability proposal will probably cover only future activities, and will not relate back to already contaminated sites. Finally, it is possible that the proposal will include a government sponsored compensation system in which governments of Member States may intervene on behalf of injured victims and the environment.

c. *Financial assurance requirements for hazardous waste facilities*

Regardless of whether a waste producer is actually sued as a result of pollution or injury caused by his hazardous waste, the potential liability for such events will affect the producer's waste management costs, primarily through the cost of insurance necessary to protect against such liability. Insurance to cover the liability of hazardous waste treatment and disposal facilities appears to be generally avail-

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<sup>281</sup> Kromarek Interview, *supra* note 229.

<sup>282</sup> The following textual discussion is based on the Krämer Interview, *supra* note 70.

able in Europe.<sup>283</sup> However, many firms probably do not insure themselves for environmental or pollution risks.<sup>284</sup> Moreover, countries such as France and Germany have not imposed comprehensive requirements for long-term financial assurance on hazardous waste land disposal facilities. Under German law, for example, new land disposal facilities can be required to provide financial assurance for matters specified in the facility license, but these requirements cannot be applied to licenses already issued.<sup>285</sup> In France, no long-term financial assurance requirements have yet been imposed on hazardous waste landfills. Government and the disposal industry have been discussing various proposals, none of which appears to provide substantial amounts of financial capacity to address cleanup costs or other liability claims.<sup>286</sup> Belgian law requires hazardous waste treatment facilities to provide an insurance policy which allows injured third parties to claim directly against the insurer, and prohibits the insurer from interposing any defenses it might have against the facility operator.<sup>287</sup>

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<sup>283</sup> INDAVER, the Flemish public-private waste management corporation, is working out the details for insurance coverage for its proposed integrated treatment and disposal facility and does not expect problems in obtaining coverage. Kucnerowicz Interview, *supra* note 14. The Cologne Chamber of Commerce has found an insurance company willing to cover liability for groundwater contamination from a disposal facility proposed by the Chamber. Kromarek Interview, *supra* note 229. Environmental pollution insurance is available to facilities operating under the registered installation law in France through a special policy known as "GARPOL." The policy coverage may include cleanup of pollution required under an administrative order or agreement with the insured or insurer. PRIEUR, *supra* note 90, at 1076-78.

<sup>284</sup> Environmental insurance coverage in France has been described as follows:

The average industry does not consider that pollution risks require special coverage unless it has already had an accident. Very often the practice of negotiated settlements with victims tends to lessen the importance of the pollution problem in the minds of certain industry managers and does not encourage them to purchase supplementary coverage that increases their costs. Large firms frequently self-insure for pollution risks.

PRIEUR, *supra* note 90, pp. 1074-75 (translation by Author).

<sup>285</sup> Liability Issues, *supra* note 259, at 6; and Kromarek Interview, *supra* note 229.

<sup>286</sup> Interview with Emmanuel Pérol, Directeur Général, France-Déchets, in Villeparisi, France, (Apr. 4, 1986); Lemarchand Interview, *supra* note 34. The Ministry of the Environment has proposed a fee of 10 Francs per ton on waste accepted by a disposal facility. Industry has proposed a 7 Francs per ton charge, of which 4 Francs would be paid by the waste producer and 3 Francs by the disposal facility operator. Based upon an estimate of 400,000 tons of disposed hazardous waste per year in France, these proposals would raise the equivalent of about \$615,000 or \$430,000 annually to provide financial assurance for thirteen facilities. In addition, a proposal has been made to require financial assurance as a condition of approval of a land disposal facility under Article 9 of the Framework Law. Law 75-633 of July 15, 1975, J.O. 7279-81. This assurance would have to be maintained after closure of the landfill, perhaps for up to 30 years. Damages above a certain limit or after the 30 year period would be paid by the government. RAPPORT SERVANT, *supra* note 32, at 34.

<sup>287</sup> Liability Issues, *supra* note 259, at 6.

*d. Conclusion*

While Europe has experienced a serious problem with old contaminated waste sites that will require substantial expenditures for cleanup and monitoring, this has not led to any major change in liability laws applicable to waste producers. In general, waste that is delivered by the producer to another party for treatment or disposal, at least in the absence of negligence or illegal conduct, will not give rise to further liability for the producer. Insurance remains available to cover pollution risks. Finally, the lack of requirements for long-term financial assurance for land disposal facilities means that the cost of potential future liability claims probably is not adequately reflected in disposal costs. Thus, liability of waste producers for damages attributable to their waste, and the costs associated with that liability, do not appear to provide a strong incentive to European waste producers to minimize the production of hazardous waste.

### 3. Taxes and Fees in Waste Minimization

Another way for government to encourage minimization of hazardous waste is to impose taxes or fees on the generation of waste or on the use of raw materials for products that contribute to hazardous waste streams when discarded. In the countries visited by the Author, the use of taxes and fees seems to be almost insignificant as an incentive to minimize hazardous waste. None of the countries has a system of fees or taxes currently in force that applies to hazardous waste production or to raw materials contributing to hazardous waste streams. However, proposals under discussion in Germany and France could change this situation.

France has instituted a temporary tax to be used by ANRED to support the collection and recovery of used oil.<sup>288</sup> This tax is imposed on newly refined or imported lubricating oils, not the used oil itself.<sup>289</sup> The Fourth Amendment to the German Waste Act authorizes the government to impose a deposit on certain products which pose a problem for land disposal when they are discarded.<sup>290</sup> The purposes of this provision are to encourage production of "environmentally friendly" products and to encourage separate collection, treatment,

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<sup>288</sup> Decree No. 86-549, *supra* note 30.

<sup>289</sup> *Id.* arts 2-4.

<sup>290</sup> Act of Aug. 27, 1986, BGBl.I 1410 (amending Waste Disposal Act, June 7, 1972 BGBl.I 1410); *supra* notes 125-30 and accompanying text.

and disposal of discarded products that threaten to pollute the environment. This law has not yet been implemented and its potential impacts are not known.

Tax and fee proposals have been made in France and Germany which could have a significant effect on waste production. In France, there has been discussion for a number of years about imposing a fee on waste production which would be similar to that already imposed on water pollution discharges.<sup>291</sup> The discussion has provoked interagency rivalry between ANRED and the River Basin Finance Agencies concerning the appropriate agency to collect the fees and administer the revenues. The debate does not seem to be headed toward resolution soon. The effect of such a fee system would obviously depend upon the rates charged and the extent to which revenues would be devoted to waste prevention and minimization. One such hazardous waste fee was proposed in 1984 by the Environment Ministry Working Group presided over by Jean Servant.<sup>292</sup> The proposal was based on the water pollution fee system, with the tax rate dependent on the toxicity or risk to the environment, and with deductions given for waste recovered or recycled.<sup>293</sup> Revenues would have been administered by the regions (and by ANRED for national projects) to support improved waste management. This proposal was never enacted by the French government.

In Germany, the Green Party and the Social Democrats, currently minority parties in the Bundestag, have proposed a federal tax on chlorine as a raw material contributing to the creation of hazardous waste, and a surcharge on certain types of hazardous waste. Under the proposal made by the Green Party, the tax on chlorine would be set at 300 D.M. (about \$150) per ton for the first five years and 500 D.M. per ton thereafter.<sup>294</sup> The tax would raise about 700 million D.M. (about \$350 million) per year, which would be distributed by the Federal government for the cleanup of old contaminated sites.<sup>295</sup>

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<sup>291</sup> Olier Interview, *supra* note 26; Raak Interview, *supra* note 24.

<sup>292</sup> RAPPORT SERVANT, *supra* note 32, at 35-36.

<sup>293</sup> *Id.*

<sup>294</sup> Interview with Ulrike Riedel, Legal Advisor to the Green Party, at the Bundestag, Bonn, (Apr. 24, 1986) [hereinafter Riedel Interview].

<sup>295</sup> *Id.* The current situation in Europe with respect to the cleanup of old contaminated sites differs dramatically from the situation in the United States. With the exception of the Netherlands, where about \$800 million has been committed to cleanup so far, none of the countries visited by the Author has established a national program with substantial financial resources to clean up old waste sites. See Soil Rehabilitation Law of December 29, 1982. See also Liability Issues, *supra* note 259, at 9; Henselmans Interview, *supra* note 47.

In France, ANRED and the Ministry of the Environment assist in the investigation and

It is estimated that the cost to clean up all contaminated sites in Germany would range from 15 to 20 billion D.M. (about \$7.5 to 10 billion).<sup>296</sup> In addition, the states would be authorized to collect surcharges on hazardous waste production and to use the revenue for site cleanup or other waste management improvements. The waste surcharges would be based on the toxicity of the waste and could range from 150 D.M. per ton for heavy metal sludges to 30 D.M. per ton for solvent wastes. If the waste is recycled, the surcharges would not apply. This proposal is clearly designed to discourage the use of chlorine in products and to encourage avoidance, reduction and recycling of hazardous waste. The Social Democratic Party supports a similar proposal.<sup>297</sup> These proposals seem to have little or no chance of enactment under the current political majority in the Bundestag.<sup>298</sup>

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cleanup of contaminated hazardous waste sites. According to the Ministry of the Environment, 106 sites have been the subject of investigation or cleanup activities pursuant to this law from 1978 to 1986. MINISTRY OF THE ENVIRONMENT, POLLUTION PREVENTION OFFICE, INDUSTRIAL ENVIRONMENT SERVICE, LES ANCIENS DÉPÔTS DE DÉCHETS INDUSTRIELS, 18 (1986). ANRED may make loans to responsible parties covering ten to thirty-five percent of the cost of cleanup. The loans are generally for ten years at ten percent interest. If a new public water supply is required, ANRED may make available additional loans. Lemarchand Interview, *supra* note 34. ANRED has extremely modest resources for cleanup purposes. In 1983, only 3.5 million Francs (about \$540,000) was available for all cleanup responsibilities at ANRED. In 1985, that amount *declined* to 1 million Francs (about \$140,000). *Id.* By contrast, the total cost of the ten most expensive site cleanups completed in France up to January of 1985 was almost 28 million Francs. ANRED, LA RÉSORPTION DES DÉPÔTS DE DÉCHETS DANGEREUX, 13 (1985) [hereinafter ANRED Cleanup Report].

The management of old land disposal facilities in Europe has also attracted the attention of international organizations, including the Commission of the European Community. See ECOTECH, THE RE-USE OF LANDFILL SITES: A RESEARCH STUDY FOR THE COMMISSION OF THE EUROPEAN COMMUNITIES (1985). The European Community could become the forum for resolving issues such as identifying sources of public funding for site cleanup and setting uniform standards for financial contribution from private industry. Yakowitz Interview, *supra* note 74.

<sup>296</sup> Staube Interview, *supra* note 277.

<sup>297</sup> Hartenstein Interview, *supra* note 127.

<sup>298</sup> Two issues seem to be stalling action on federal site cleanup legislation. First, the contaminated sites are concentrated in the northern part of Germany, which has been heavily industrialized for a century or more, while the south, where industrial development has occurred more recently, has fewer sites. The unequal geographical distribution of sites makes it difficult to reach a national consensus on cleanup measures. Hüllmantel Interview, *supra* note 106. Second, there are legal difficulties in designing a financing mechanism to raise the money needed for cleanup. Under German law, user charges, which are usually levied by State governments, must be related to benefits received by the paying industry. A user charge paid by waste producing industries that is dedicated to cleanup of contaminated sites for which the industries are not legally responsible may not be permissible. Staube Interview, *supra* note 277; Riedel Interview, *supra* note 294. Although taxes could be levied by the federal government to raise funds for cleanup, tax revenue cannot legally be dedicated for

D. *The Role of the Private Sector in Waste Minimization:  
Industry Policies and Practices*

Developing and implementing policies to minimize hazardous waste production is not exclusively a governmental task. While government can encourage or even require industries to take steps to avoid or reduce waste production, it is industry that must carry out the actions necessary to accomplish the desired results. Industry can take an active or reactive role in this process. This section of the Study examines industry's efforts to take an active role in setting policies and procedures aimed at minimizing waste production and implementing programs and investments to carry out a waste minimization strategy.

1. General Factors Influencing Development of Industry Policies and Practices

Approaching the question from the industry point of view, there are a number of important factors that influence industry to develop and carry out strategies to minimize hazardous waste production. The most important single factor in determining the attitude of an individual business toward waste minimization is the economic impact that the minimization activities will have on the industry; that is, the effect of minimization on reducing costs and increasing profits.<sup>299</sup> Another important factor is the availability of economic and technical resources to devote to the problem. This factor is often a matter of the size of the business; smaller businesses in general lack both the technical know-how and the financial capability to carry out waste minimization activities. Regardless of other factors that may cause an industry to want to minimize its waste production, very little action is likely to result where the business is unaware of waste minimization alternatives or cannot afford to implement them.

The industrial firms visited by the Author were large companies, often among the largest chemical companies in their respective countries. These industries were well-informed about waste management issues and possessed the technical and economic resources to initiate strategies to minimize waste production and reduction efforts.<sup>300</sup> They also enjoy an institutional stability and continuity that encour-

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specific purposes such as site cleanup. Money for cleanup would therefore have to be appropriated annually by the Bundestag. Riedel Interview, *supra* note 294.

<sup>299</sup> Yakowitz Interview, *supra* note 74; see *supra* note 229.

<sup>300</sup> Pétilot Interview, *supra* note 137; Goosmann Interview, *supra* note 42.



age them to address issues such as waste management from a long-term point of view of enlightened self interest.<sup>301</sup> Large companies also can develop an efficient internal solution to their waste management problems, without relying on commercial facilities or services. The factors generally cited by these organizations as the reasons for developing waste minimization programs include: avoidance of regulatory compliance costs; avoidance of treatment and disposal costs; increased efficiency in the use of raw materials and in production methods; competition from other industries; and protection of the public reputation or image of the company.<sup>302</sup> These and other factors are mentioned in more detail in the description of industry policies and practices that follows.

## 2. Waste Minimization Policy and Practice in European Industries

The reduction and prevention of hazardous waste production is recognized by European industry as a desirable goal. In its statement of principles for sound waste management, the European Council of Chemical Manufacturers' Federations (CEFIC), adopts as its first principle to "[t]ake all economically and technically justifiable measures to minimize generation of waste, through process optimization or re-design."<sup>303</sup> To carry out this principle CEFIC recommends that chemical companies incorporate waste minimization into their operations at three levels: (1) in research and engineering activities, including process development and plant design; (2) at the production site, through the inventory and monitoring of waste generation; and (3) at the senior management level in approving new projects.<sup>304</sup> The recommendations emphasize the importance of production efficiency, quality control, and avoidance of waste-producing accidents in the manufacturing process. The second principle adopted by CEFIC is to "[s]eek every opportunity for the economic recovery of residues, as feedstock, for energy production, or any other purpose."<sup>305</sup> Reducing the quantity of waste requiring disposal is one of the express purposes behind this principle. However, the chemical industry is quick to point out that, while waste minimization may be the best method to manage hazardous waste,<sup>306</sup> there will always be

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<sup>301</sup> Schendel Interview, *supra* note 99.

<sup>302</sup> Preusker & Skalicky Interview, *supra* note 186; Salamitou Interview, *supra* note 229; and Schendel Interview, *supra* note 99.

<sup>303</sup> CEFIC, *supra* note 246, at 5.

<sup>304</sup> *Id.*

<sup>305</sup> *Id.* at 6.

<sup>306</sup> Hulpke Interview, *supra* note 74.

wastes and waste residues for which there are no alternatives but disposal.<sup>307</sup>

Individual companies have also developed policies concerning waste minimization and are taking various steps to implement these policies. Rhone-Poulenc offers an example of such activity in a major French chemical company.<sup>308</sup> The Director of Environmental Protection of the company cites three reasons why Rhone-Poulenc seeks to reduce its hazardous waste production: (1) to protect the company's public image and the image of its products; (2) the difficulty of establishing new facilities to treat and dispose of hazardous waste;<sup>309</sup> and (3) the economic impact of treatment, disposal, and regulatory compliance costs. Of these reasons, economic impact and public image were cited as most important. Waste minimization at Rhone-Poulenc begins with a company policy on pollution which is centered on waste management.<sup>310</sup> Under this policy, clean technologies which prevent the creation of pollution at the source, are given highest priority.<sup>311</sup> Recycling and recovery, followed by treatment, are the next preferred alternatives. Finally, disposal is considered the method of last resort.<sup>312</sup>

One method of carrying out this general waste management policy at Rhone-Poulenc is through the design and review of new investment projects. This begins at the research and engineering stage for a new manufacturing facility, where methods to avoid or reduce pollution are sought before exploring ways to treat or dispose of waste residues. During the design phase, the Office of Environmental Protection is consulted on pollution matters. When the design is completed, that Office audits the environmental soundness of the final proposal before it is reviewed by the Strategic Committee of the company for approval of the investment. This system is complemented by a research component in which Rhone-Poulenc seeks to develop new low waste or non-waste production technologies, and by education of personnel who operate manufacturing plants concerning pollution prevention.

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<sup>307</sup> *Id.*; CEFIC, *supra* note 246, at 3, 5, and 9.

<sup>308</sup> Information on Rhône-Poulenc is derived from an interview with and documents provided by M. Jacques Salamitou, Director of Environmental Protection. Salamitou Interview, *supra* note 229.

<sup>309</sup> Although Rhône-Poulenc manages most of its waste in proprietary facilities, it also uses some commercial facilities.

<sup>310</sup> Rhône-Poulenc, *Anti-Pollution: Ce Que Fait Rhône-Poulenc*, (Anti-Pollution: What Rhône-Poulenc Is Doing), undated, Paris.

<sup>311</sup> *Id.* at 2.

<sup>312</sup> *Id.* See Rhône-Poulenc, *Prise en Compte de l'Aspect Environnement chez Rhône-Poulenc* (Taking the Environment Into Account at Rhône-Poulenc). (Apr. 5, 1984).

Another example of a major European industry with a specific waste minimization strategy is Shell, the Dutch petro-chemical company.<sup>313</sup> Shell's policy on environmental protection, though quite general, includes a statement on waste control options which implies that waste reduction should be the highest waste management priority, followed by treatment, and finally disposal of remaining residues. In discussing waste reduction, the Shell policy states:

Any change in a process leading to minimization of the quantities of waste, or enabling it to be re-used, recycled or recovered, tackles the problem at its source. Such process changes can lead to savings in material and energy as well, and the recovered product(s) may be saleable to other industries. As a consequence, they reduce the ultimate cost for treatment and storage and the need for disposal sites.<sup>314</sup>

Shell implements this general policy through centralized review of the practices and proposed new investments of all Shell operations, and by requiring managers of production units to keep budgets of the quantity of waste produced and the costs of waste management. Shell also designates a manager at each plant who is responsible for that plant's waste.

The unique part of the Shell strategy to minimize hazardous waste is the waste budget.<sup>315</sup> Each manager of a production operation is required to keep a record of the types and quantities of waste produced by that operation and the costs incurred to treat or dispose of it.<sup>316</sup> Based on information supplied by the operating divisions, a management team determines the amount of waste of each type which may be produced by each production unit. These amounts may vary according to the processes used and the amount of product produced. However, the rate of waste production set by the budget should not be exceeded. These waste budgets are a decision-making tool allowing managers to see the cost impact of waste production and minimization, and encouraging them to take waste management

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<sup>313</sup> The Author interviewed the Director of Environmental Affairs of Shell-U.K., Mr. John Eberlein. See Eberlein Interview, *supra* note 58, and H. Noordmans and H. Jacobs, officials of Shell-Rotterdam, a facility employing 6000 people in the Netherlands, Noordmans & Jacobs Interview, *supra* note 238.

<sup>314</sup> Shell International Petroleum Company Limited, Environmental Briefs-Waste Management (Dec. 1984). According to John Eberlein of Shell-U.K., the driving force behind waste reduction is economics, because waste production means loss of product yield, use of energy, and additional disposal costs. Eberlein Interview, *supra* note 58.

<sup>315</sup> The waste budget was described by officials at Shell-U.K. and Shell-Rotterdam.

<sup>316</sup> The Shell-Rotterdam plant includes 45 production sections each of which has its own waste budget. Noordmans & Jacobs Interview, *supra* note 238.

into account in evaluating plant performance.<sup>317</sup> To insure that unit managers cannot ignore waste management costs, the production units are required to pay for waste management activities that are performed by other divisions within the Shell organization. Thus, even internal waste management costs must be accounted for.

Another example of action by a European industry to minimize hazardous waste production is provided by ICI, the largest chemical company in the United Kingdom. ICI is developing new production processes to make water-based paints that do not require the use of chemical solvents.<sup>318</sup> This action is particularly interesting because there is no national policy favoring hazardous waste minimization in the U.K. and few incentives to encourage industry to minimize waste production. ICI's investment in the development of a new paint-making process is the result of regulatory pressure from Germany and France to reduce the emissions of solvents into the environment.<sup>319</sup> While the new process reduces if not eliminates the need for organic chemical solvents, the raw materials used to make the water-based paint are highly reactive and therefore dangerous to handle and transport. The production process also requires two to three times the amount of heat required to make oil-based paints. This example illustrates that the environmental and health benefits of waste reduction cannot be fully evaluated without considering the potential adverse impacts of the new or modified production process.

Finally, these examples of the role of the private sector in hazardous waste minimization in Europe must include a reference to private organizations providing consulting, technical and engineering services to facilitate improved waste management. Organizations visited by the Author included: APORA, the Industrial Association for Pollution Prevention for the Rhone-Alpes Region; FAIRTEC, a private French corporation providing technical and engineering services and recycling and recovery equipment to the metal finishing industry; the German Chemical Manufacturer's Federation in Frankfurt; the Cologne Chamber of Commerce; and ECOTEC, a private consulting firm in Birmingham, England, which has conducted nu-

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<sup>317</sup> BASF, a major German Chemical Company, takes a somewhat more active approach to waste minimization. The central management of BASF requires its divisions to show that the waste they produce could not be avoided. Each division also keeps track of its waste management costs as an incentive to keep the costs low. A company-wide waste exchange has been established to encourage recycling and reuse as an alternative to more costly methods. Jung & Platz Interview, *supra* note 110.

<sup>318</sup> Chadderton Interview, *supra* note 247.

<sup>319</sup> *Id.* ICI has seven manufacturing plants in France and Germany.

merous studies on waste management issues particularly for the European Community.<sup>320</sup> These entities represent the type of private organizational infrastructure that is needed to assist waste producers to identify alternative waste minimization methods, evaluate the cost and benefit of implementation, and find the technical and financial resources necessary to get the job done. European countries do not seem to have developed the kind of public technical assistance programs that are beginning to appear in the United States.<sup>321</sup>

#### IV. RECOMMENDATIONS FOR HAZARDOUS WASTE MINIMIZATION POLICY IN THE UNITED STATES

In addition to encouraging better understanding of European policy and practice in the field of hazardous waste management and minimization, this study suggests a number of policy alternatives that may be useful in encouraging hazardous waste minimization in the United States. In making the recommendations in this section of the article, the Author recognizes that European policy and practice may not always be easily translatable into the context of American experience in hazardous waste management and regulation. Nevertheless, European experience with waste minimization may challenge policy makers in the United States to reexamine their assumptions about effective waste minimization measures and to consider additional policy alternatives.

*A. Public policy designed to promote hazardous waste minimization should be based on a comprehensive, creative, and multi-faceted approach.*

European experience shows that there are many factors that can encourage generators to reduce the production of hazardous waste and that most, if not all, of these factors are subject to the influence of public policy. Economic factors are probably the single most im-

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<sup>320</sup> See *supra* notes 206, 221, and 295, for reports prepared by ECOTEC.

<sup>321</sup> At least eleven states have established offices to provide a variety of services to waste producers such as information clearing houses, educational and informational programs, technology transfer activities, on-site visits and waste audits, and advice on specific waste reduction methods. States offering one or more of these services include California, Georgia, Illinois, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Carolina, Tennessee and Washington. EDF Report, *supra* note 9.

portant in encouraging waste minimization. Government actions that require the use of more environmentally sound treatment and disposal methods are likely to increase waste management costs and encourage waste reduction. Liability laws in the United States such as CERCLA and similar state laws provide incentives for waste reduction that do not exist to the same extent in Europe. The value of such liability laws as a tool of self-imposed regulation of waste management activities by generators should not be overlooked.

While the cost of managing hazardous waste is very important in encouraging waste reduction, countries such as Germany and the Netherlands have recognized that higher waste management cost is not necessarily enough to cause generators to adopt waste reduction measures. A comprehensive public policy on waste minimization should include appropriate regulatory requirements designed to directly affect waste production, recycling and reuse. It should also include positive economic incentives such as grants, loans and technical assistance to support changes in management methods and production technologies.

An effective public policy on waste minimization should have as its underlying premise that waste minimization is both profitable to industry and beneficial for the protection of the environment and public health. Waste minimization policy should be designed to convince industry, and others who are in a position to influence industry behavior (for example, insurance companies and financial institutions), that waste minimization serves industry's economic interests. When it has convinced industry of the benefits through information, education, or regulation, government should stand ready to assist in the implementation of waste minimization measures through technical assistance and, where the public benefit justifies it, financial incentives.<sup>322</sup>

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<sup>322</sup> Private organizations may also be able to play a constructive role in convincing and encouraging others to implement minimization projects. One example is a joint project of the Environmental Defense Fund, a private environmental interest group, and the Metropolitan Water District of Southern California to identify sources and amounts of toxic wastes produced in the major groundwater basins in the District, and to select specific chemicals and a specific basin as a practical example of the potential for reducing the production of toxic wastes at the source. The project developed from a common recognition by the Fund and the District that the long term solution to contamination of water supplies is prevention and that source reduction should be a part of any preventive strategy. See Joint Press Release by Environmental Defense Fund and Metropolitan Water District of Southern California (Dec. 9, 1986); Memo from the General Manager to the Board of Directors of The Metropolitan Water District of Southern California (Oct. 30, 1986).

Finally, although definitions can lead to unnecessary debate and disagreement over the scope of a waste minimization policy, it should be noted that the list of activities generally considered to contribute to waste reduction in Europe is a broad one. Thus, most European policy makers would probably consider everything from improvements in management and organization of production, through process modification, new production processes, product and raw material substitution, and re-use and recycling of waste (both at and away from the site of production) as legitimate means to reduce or minimize the quantity of hazardous waste that poses a problem to health and the environment. While the long term and short term risks and benefits of each of these activities may vary, a comprehensive approach to waste minimization should consider the appropriate role of each alternative in attempting to achieve overall objectives.

*B. To the extent possible, regulations designed to directly encourage prevention and reduction of hazardous waste by industry should be incorporated into existing forms of environmental regulation. Implementation of waste minimization regulations should be supplemented by financial and technical assistance to facilitate compliance.*

Regulatory programs designed to encourage minimization of hazardous waste in countries such as France, Germany, and the Netherlands have typically been coordinated with or incorporated into pre-existing environmental regulations, with enforcement supplemented through government-sponsored technical and financial assistance. While the structure of pre-existing environmental regulations in the United States may differ from that in European countries, the general approach of integrating new waste minimization requirements into current regulatory programs offers a useful model for United States policy makers.

Coordinating waste minimization requirements with existing regulatory programs has a number of advantages for government and for those subject to the regulations. Incorporating new regulatory programs into older, more well-established programs may allow more efficient use of public resources, and avoid unnecessary time and expense to generators attempting to comply with new requirements. A coordinated enforcement strategy, using existing regulatory information to identify generators who should be subject to waste minimization requirements, may help to develop a comprehensive approach to avoiding cross-media pollution. For example, if

industrial facilities with air emissions permits were required to review their waste production and management, they might identify new air pollution control methods that reduce waste residuals as well as air pollution.

Industries that generate hazardous waste are subject to a variety of environmental regulations designed to control the way that the waste is managed. Hazardous waste generators must file certain reports and disclosures concerning the types and amounts of waste generated, manifest any shipments of waste that leave the place of generation, and obtain a permit for any regulated storage, treatment and disposal activities that are carried out at that place.<sup>323</sup> Generators may also be subject to other types of environmental regulations. For example, an industrial facility that generates hazardous waste may also produce discharges of pollutants to the air or water that require it to obtain federal or state permits. Construction of a new industrial facility that is subject to environmental permits or other state or local controls may require the preparation of an environmental impact statement.<sup>324</sup>

In each of these examples, environmental regulators have the opportunity to require an already regulated industry to identify and evaluate its hazardous waste production and to consider how that production could be reduced. Regulations could also require generators to carry out waste audits to evaluate management and production methods responsible for producing waste and to identify alternative, practical methods by which waste production could be minimized. Where the identified methods are technically and economically feasible, implementation could be encouraged by means of positive or negative economic incentives or, as a last resort, could be required.

Some steps have already been taken in this direction. Under the 1984 RCRA Amendments, generators that ship hazardous waste are subject to two waste minimization requirements. First, they must certify on the manifest accompanying any shipment that they have a program in place to reduce their waste to the degree determined by the generator to be "economically practicable."<sup>325</sup> Second, the generator must report to the U.S. Environmental Protection Agency

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<sup>323</sup> RCRA, *supra* note 1, §§ 6922-6925.

<sup>324</sup> See, e.g., Minn. Stat. Section 116D.04 and Minn. Rules 4410.4300 and 4410.4400, which require preparation of an environmental impact statement (EIS) or environmental assessment worksheet (a preliminary step to an EIS) for certain types of industrial developments.

<sup>325</sup> RCRA, *supra* note 1, § 6922(b)(1).



every two years on the efforts it has undertaken to reduce its production of waste and the changes actually achieved.<sup>326</sup> Generators that manage their wastes on-site under a treatment, storage, or disposal permit must make an annual certification concerning their waste reduction program in the same manner that other generators certify this on waste manifests.<sup>327</sup> These certifications and reports, however, do not give rise to any substantive requirement to take any particular waste minimization actions. The RCRA waste minimization provisions help to draw the generator's attention to the problem of waste reduction, but leave implementation largely to the generator's own discretion and initiative.<sup>328</sup>

The State of California has taken waste minimization regulation a step further by imposing a fee on generators who send hazardous waste for disposal when the waste has been found to be recyclable.<sup>329</sup> The state may find that a hazardous waste is recyclable in two ways. First, the state can place the waste on a list of hazardous wastes that are economically and technologically feasible to recycle, based on a number of statutory criteria. Alternatively, the state can find that a waste is recyclable if it is able to provide the name of a ready and willing purchaser of the waste. In either case, the state may order the generator of such a waste to recycle it or to pay a fee equal to the cost of disposing the waste.<sup>330</sup>

Whatever regulatory measures may be chosen to directly encourage generators to reduce the production of hazardous waste or to provide for greater recycling and reuse, there must be a sufficient commitment of government personnel and resources to implement the measures. Government must compile information on feasible waste minimization methods and provide technically trained regulatory personnel who can evaluate the alternatives available to a generator to comply with the regulations. Enforcement of waste minimization regulations should focus on facilitating compliance rather than penalizing non-compliance. Thus, for example, it may be appropriate for government to share the cost of any waste audits that generators are required to perform.

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<sup>326</sup> *Id.*, § 6922(a)(6)(C) and (D).

<sup>327</sup> *Id.*, § 6925(h)(1).

<sup>328</sup> OTA Report, *supra* note 7 at 14.

<sup>329</sup> CAL. HEALTH AND SAFETY CODE § 25175 (West 1984).

<sup>330</sup> "Overview of Legal/Institutional Incentives to Implement Alternatives to Land Disposal," unpublished paper from proceedings of Second Annual Hazardous Materials Management Conference, West Long Beach, California, December 3-5, 1986, by Patrick Dennis, Attorney, Los Angeles California, pp. 434-35.

Waste minimization can also be incorporated into the enforcement of existing environmental regulations by making the implementation of waste reduction measures a condition of resolving regulatory violations. This approach has recently been taken in the settlement of a case of illegal hazardous waste disposal in Pennsylvania. Under the terms of an agreement between the state and a steel company, a fine for illegal disposal was reduced from \$30,000 to \$15,000, with suspension of that amount if the company installs waste reduction equipment valued at more than \$100,000.<sup>331</sup>

*C. Government at both federal and state levels should provide the necessary financial resources to encourage industry to demonstrate and adopt technologies and practices to minimize hazardous waste production.*

France, Germany, and the Netherlands have led the way in providing governmental support for the development, demonstration, and implementation of new technologies to reduce or prevent the generation of hazardous waste. The federal government and state governments should commit significant financial resources for similar programs in the United States. Financial resources should be made available in the form of grants and loans to industry to develop, demonstrate, and adopt new and modified technologies to minimize the production of hazardous waste. Assistance should be focused on projects that will have a wide practical application to other industrial firms and that are designed to convince industry that new methods are technically and economically feasible. Financial assistance is especially important for smaller firms that are less able to take the technical and economic risks involved in adopting new or modified production methods.

When public financial assistance is provided for the development or demonstration of new technologies, government should require that the new technologies be made generally available to other industries. If the project involves new equipment that is incorporated into the continuing operation of a firm and contributes to its profitability, government should consider repayment of part or all of the assistance. Successful demonstration projects should be publicized to the industrial community and the public at large, both to recognize the achievement of the participating industry and to encourage others to follow the example.

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<sup>331</sup> Hazardous Waste Report, (looseleaf service) September 1, 1986 p. 16.

*D. Government, educational institutions, and private industry should cooperate to support a broad range of research, development, training, and educational activities designed to create and diffuse knowledge and professional expertise on hazardous waste minimization.*

European experience offers many examples of active involvement by both public and private organizations and institutions in developing and disseminating information and expertise regarding hazardous waste management in general, and waste minimization in particular. In Germany, the UBA coordinates research projects that are carried out by both private industry and public universities,<sup>332</sup> and supports technical assistance to waste generators in cooperation with state government and private industry groups.<sup>333</sup> In France and Germany, industry associations have become actively involved in providing assistance to their members on ways to improve waste management and comply with regulations.<sup>334</sup> In the U.K., the National Center for Scientific Research at Harwell Laboratories has established a program specifically devoted to waste management problems.<sup>335</sup>

In the United States, many public and private institutions exist that are capable of providing significant support for hazardous waste minimization programs. Public and private leaders who are enlightened about the need for and advantages of waste minimization should take the initiative to win the support of institutions such as industry trade associations, research universities, and engineering schools for programs designed to encourage waste reduction. These programs could include technical research to develop new, cleaner production methods and recycling techniques; training and internship programs to sensitize engineering graduates to the importance of waste minimization in the design of new industrial facilities, processes, and products; and educational and outreach programs to disseminate information to generators that lack the in-house technical capabilities to implement waste minimization measures. Those responsible for these programs should encourage the flow and exchange of ideas on waste minimization methods and policies between the United States and other industrially developed regions of the world, particularly

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<sup>332</sup> See Part II.B.2.(b) of this Article.

<sup>333</sup> *Supra* note 182 and accompanying text.

<sup>334</sup> See *supra* notes 161, 183, 186, and 188 and accompanying text.

<sup>335</sup> See *supra* note 203 and accompanying text.

countries such as France and Germany that have large and diverse economies similar to the American economy. An important goal of these programs would be to institutionalize an understanding that concerted efforts to minimize hazardous waste production can enhance industry productivity, competitiveness, and profits, and can also improve the protection of public health and the environment.

*E. Strategies to reduce the production of hazardous waste should include efforts to modify products that contain hazardous constituents and pose a danger to the environment when discarded.*

Unites States policy and practice with regard to hazardous waste management and regulation focuses largely on the industrial and commercial generator of hazardous waste. This policy ignores the health and environmental impact of the disposal of huge amounts of discarded products containing hazardous constituents. Disposal of these products generally involves nothing more than deposit in the nearest trash or garbage container. Hazardous constituents present in this waste mixture may escape into groundwater due to chemical reactions and leaching after the waste is deposited in a land disposal facility, or may be emitted into the air when the waste is incinerated.

The production of environmentally sound products, that is, products that do not pose a threat to the environment during their use or when discarded, should be an explicit goal of public and private environmental policy. Where products cannot be modified to eliminate this threat, measures should be initiated to assure that the products are appropriately separated, collected, and managed when they are discarded. Regulatory measures to encourage achievement of this objective include product labelling, deposit fees on the purchase of products, and collection and disposal requirements for discarded products. Other measures could include public support for collection programs and centers designed to separately manage household and consumer products that are hazardous or contain hazardous constituents.<sup>336</sup>

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<sup>336</sup> Bonn and Cologne in Germany, and Rotterdam in the Netherlands, have instituted programs for the separate collection and disposal of hazardous waste that is generated by households and small businesses. Interviews with Heinz Welter, Director, Bonn City Sanitation Department, Apr. 28, 1986; H. Pooch, Director of Community Waste Policy, Cologne City Sanitation Department, Apr. 29, 1986; and Mary Lee Bonney, Office of Environment Inspectorate, Province of South Holland, Rotterdam, May 21, 1986.

*F. Individual industrial firms should adopt internal policies to reduce the generation of hazardous waste, and develop programs to enforce these policies.*

A number of major European chemical manufacturers have recognized that there are significant economic as well as environmental benefits that can be achieved by the adoption of a corporate policy to encourage the reduction and prevention of hazardous waste. Industrial firms in the United States should explore the opportunities that are available to them to improve their productivity, reduce their unproductive waste management costs, and avoid long term risks and liabilities by formulating and implementing explicit waste reduction policies. One example of such a policy is the establishment and enforcement of waste management budgets for all operating units of a manufacturing firm. Early and careful review of major investments in new production processes to ensure that the waste from such processes is minimized is another element in an effective internal industry policy to reduce waste production. Internal waste exchanges, sharing of technical expertise among divisions of the firm, and regular waste audits are additional ways that industries can make concerted efforts to voluntarily reduce their waste production. The development and implementation of internal waste reduction and prevention policies may be easier for larger firms that have sufficient in-house technical expertise and financial resources for new capital investment. Government and industry trade organizations should actively assist smaller firms to develop appropriate internal waste minimization strategies.

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